New Jersey Water Supply Plan 2017-2022 Draft

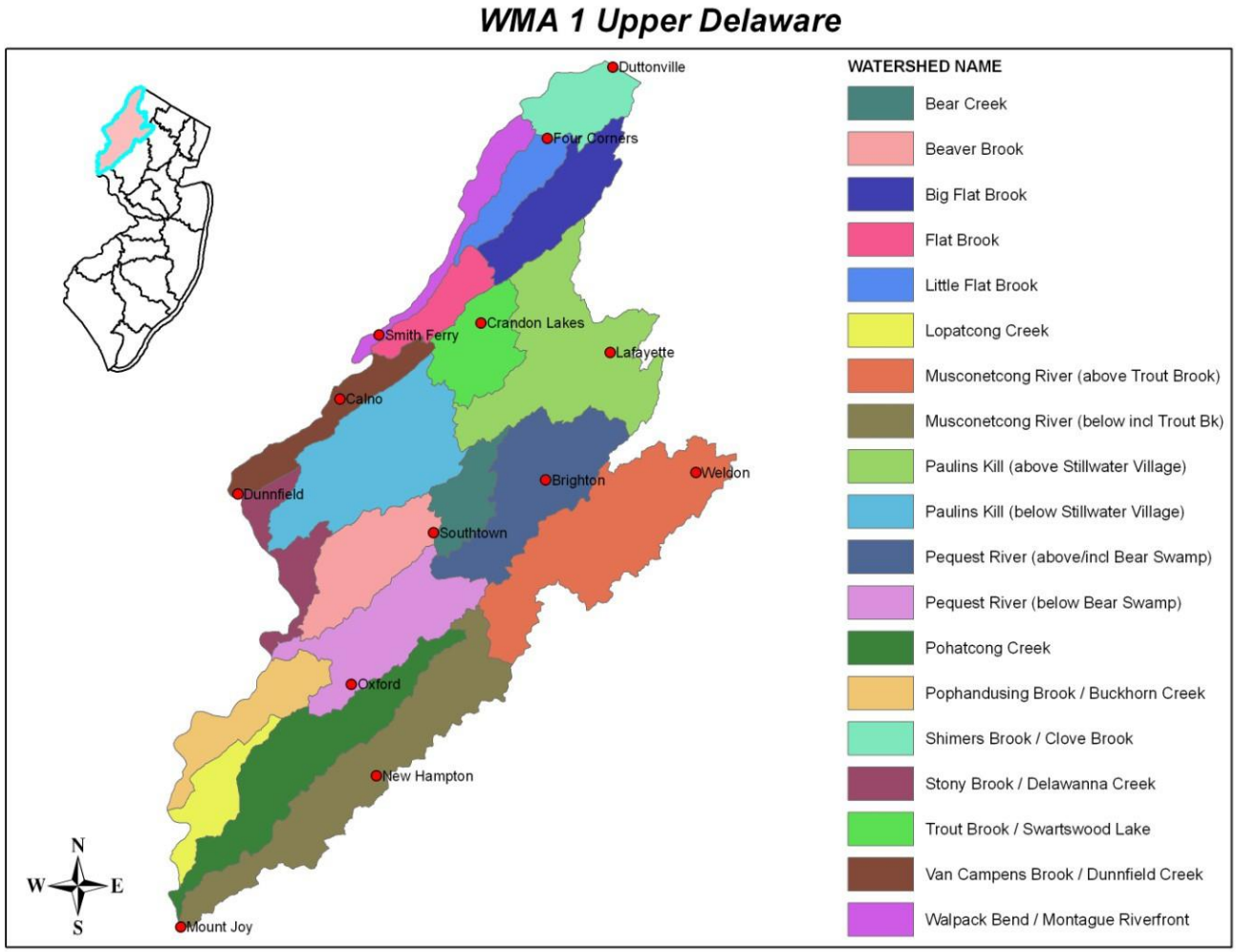
Appendix A

Characterization of Confined and Unconfined Groundwater and Surface Water Supplies

Water Supply Management Options and Recommendations

DEP analyzed data available from 1998 through 2015 to determine a period of time representing peak consumptive demand in New Jersey. Over this time period, DEP determined that the 10-year period from 1998-2007 is the period of greatest consumptive use. In performing our analysis, we used the year 2007, which was the year of greatest water consumption and therefore the year of maximum stress on the water systems of New Jersey. The overall decrease in total and consumptive use in recent years would result in an overall decrease in stressed watersheds if more recent years were used as the analysis baseline. Accordingly, the time period 1998-2007 is used in the analysis in Appendix A. This leads to the evaluation of stressed and unstressed watersheds. These results were used to generate the summaries in Chapter 3. DEP will provide the full data analysis, including for 2008-2015, as an update to this draft document.

Watershed Management Area 1: Upper Delaware



Recommended Initiatives for WMA1

1) Description of Planning Area

Watershed Management Area (WMA) 1 (Upper Delaware) is located in the northwestern corner of the State within New Jersey's Valley and Ridge and Highlands physiographic provinces. WMA 1 encompasses 739.8 square miles and contains all or portions of 54 municipalities, including all of Warren County and portions of Sussex, Morris and Hunterdon Counties. WMA 1 consists of nineteen (19) HUC11 watersheds (as depicted above), all of which generally flow in a southwesterly direction towards the Delaware River.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 1 are derived from unconfined groundwater and surface water sources. Within WMA 1, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 367.57 MGD, of which 16% was diverted from unconfined groundwater and 84% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater =58.40 MGD
Surface Water = 159.17 MGD
Regulated Surface Water = 150 MGD [1]

[1] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined ground-water withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.1.1

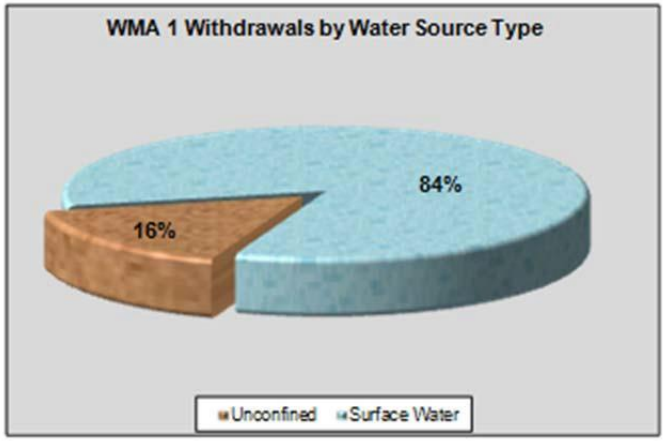
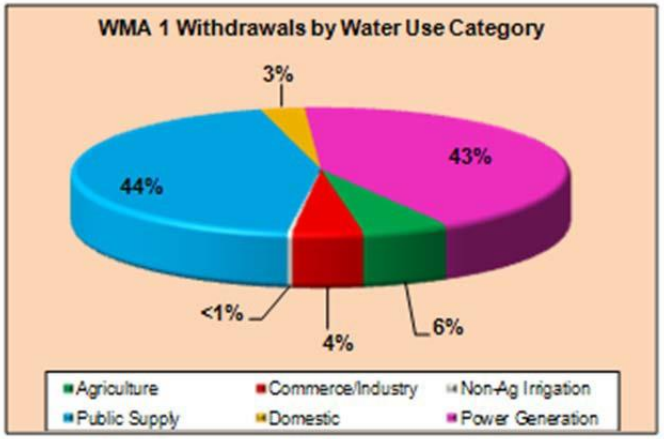


Figure A.1.2



All six water user categories (agriculture, commercial/industrial/mining, non-agricultural irrigation, public supply, domestic supply, and power generation) are represented in WMA 1. Withdrawals by water use category in WMA 1 are as follows: public supply – 161.45 MGD (93% surface water and 7% unconfined groundwater); domestic supply – 10.68 MGD (100% unconfined groundwater); agriculture – 20.71 MGD (95% unconfined groundwater and 5% surface water); commerce/industry/mining – 16.60 MGD (99.6% unconfined groundwater and 0.4% surface water); non-agricultural irrigation – 1.15 MGD (84% surface water and 16% unconfined groundwater); and power generation – 156.99 MGD (100% surface water). Refer to Figures A.1.1 and A.1.2. Note: Power generation is considered 100% non-consumptive and does not contribute to reduced water availability.

Identification of Public Community Water System's Sources

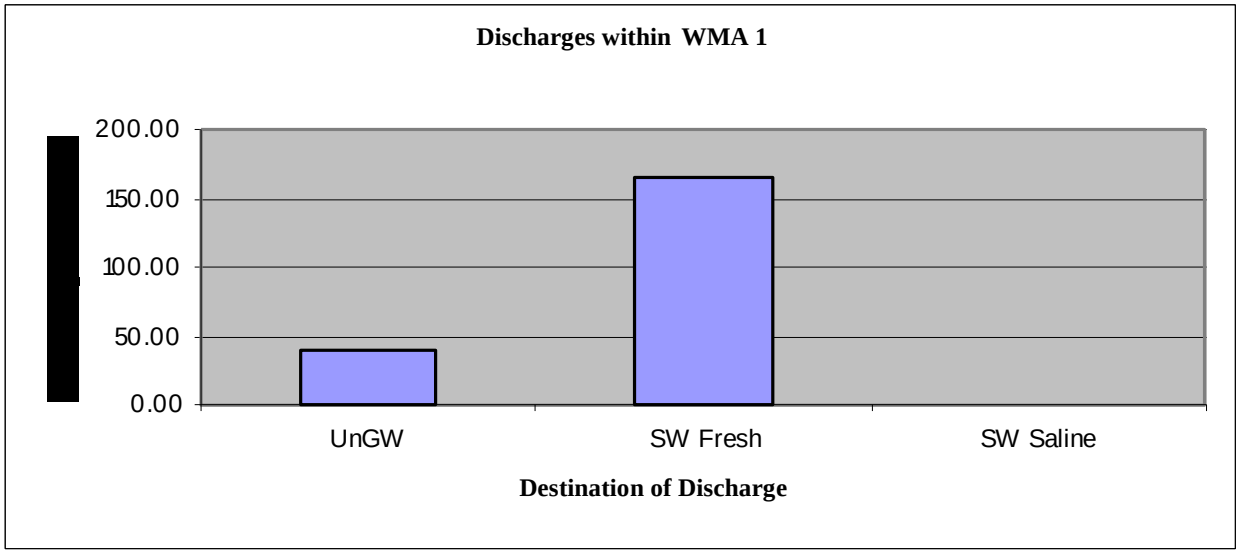
Table A.1.1 lists the purveyors who serve a population of a 1,000 or more people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 1. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.1.3.

Table A.1.1

Purveyor	Shimers Brook / Clove Brook	Walpack Bend / Montague Riverfront	Trout Brook / Swartswood Lake	Paulins Kill (above Stillwater Village)	Pequest River (above/including Bear Swamp)	Pophandusing Brook / Buckhorn Creek	Lopatcong Creek	Pohatcong Creek	Musconetcong River (above Trout Brook)	Musconetcong River (below incl Trout Brook)
Allamuchy Township Water & Sewer					U					
Alpha Municipal Water Works							U	U		
AQUA NJ INC. - Phillipsburg						U	U			
Branchville Water Department				U						
Brookwood – Musconetcong River									U	
Edna Mahan Correctional					U					
Forest Lakes Water Company					U					
Hackettstown MUA									U/S	U
Hampton Borough Water Department										U
Hopatcong Water Department									U	
Jefferson Township Water Utility – Lake Hopatcong									U	
Lake Lenape Water Company					U					
Montague Water Company	U	U								
Mount Arlington Borough DPW – Main									U	
Mount Olive Township Water Department									U	
Netcong Water Department									U	
Newton Water & Sewer Utility				U						
NJ American Water Company – Belvidere						S/U				
NJ American Water Company – Washington								U		U
NJ American Water – ITC System									U	
Roxbury Township Water Department - Shore									U	
Roxbury Township Water Department – Sky Village									U	
Sparta Township Water Utility – Seneca Lake									U	
Sparta Township Water Utility – Sussex Mills				U						
Sparta Township Water Utility – Lake Mohawk					U				U	
Stanhope Water Department									U	
Stillwater Water District			U	U						

For administrative deficit/surplus information pertaining to individual water systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.1.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.1.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 1.

Table A.1.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040104090	Shimers Brook / Clove Brook	1,675	1,818	1,960	2,161	2,358	2,515
02040104110	Walpack Bend / Montague Riverfront	635	669	706	752	799	865
02040104130	Little Flat Brook	875	923	974	1,038	1,100	1,193
02040104140	Big Flat Brook	1,898	2,016	2,139	2,297	2,450	2,646
02040104150	Flat Brook	258	259	267	268	276	297
02040104240	Van Campens Brook / Dunnfield Creek	708	783	811	838	861	890
02040105030	Trout Brook / Swartswood Lake	4,392	4,521	4,647	4,781	4,924	5,171
02040105040	Paulins Kill (above Stillwater Village)	24,197	25,580	26,963	28,286	29,609	30,942
02040105050	Paulins Kill (below Stillwater Village)	8,526	8,985	9,168	9,518	9,821	10,202
02040105060	Stony Brook / Delawanna Creek	2,604	2,820	2,940	3051	3,140	3,253
02040105070	Pequest River (above/including Bear Swamp)	13,635	14,663	16,278	17,530	18,751	19,641
02040105080	Bear Creek	2,483	2,619	2,918	3,052	3,182	3,345
02040105090	Pequest River (below Bear Swamp)	13,633	14,821	15,654	16,190	16,642	17,195
02040105100	Beaver Brook	4,255	4,582	4,717	4,915	5,079	5,291
02040105110	Pophandusing Brook / Buckhorn Creek	8,851	9,838	10,676	11,082	11,336	11,665
02040105120	Lopatcong Creek	18,733	20,806	21,838	22,613	22,962	23,469
02040105140	Pohatcong Creek	22,230	24,251	26,477	27,498	28,356	29,347
02040105150	Musconetcong River (above Trout Brook)	62,791	65,154	66,819	67,955	68,896	69,843
02040105160	Musconetcong River	23,086	24,381	25,712	26,096	26,598	27,101
WMA 1 Total Population		**215,465**	**229,489**	**241,664**	**249,921**	**257,140**	**264,871**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.1.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.1.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040104090	1,960	2,161	0.02	2,358	0.02	2,515	0.02
02040104110	706	752	0.00	799	0.00	865	0.01
02040104130	974	1,038	0.01	1,100	0.01	1,193	0.01
02040104140	2,139	2,297	0.02	2,450	0.02	2,646	0.02
02040104150	267	268	0.00	276	0.00	297	0.00
02040104240	811	838	0.00	861	0.00	890	0.00
02040105030	4,647	4,781	0.01	4,924	0.01	5,171	0.02
02040105040	26,963	28,286	0.13	29,609	0.13	30,942	0.13
02040105050	9,168	9,518	0.04	9,821	0.03	10,202	0.04
02040105060	2,940	3,051	0.01	3,140	0.01	3,253	0.01
02040105070	16,278	17,530	0.13	18,751	0.12	19,641	0.09
02040105080	2,918	3,052	0.01	3,182	0.01	3,345	0.02
02040105090	15,654	16,190	0.05	16,642	0.05	17,195	0.06
02040105100	4,717	4,915	0.02	5,079	0.02	5,291	0.02
02040105110	10,676	11,082	0.04	11,336	0.03	11,665	0.03
02040105120	21,838	22,613	0.08	22,962	0.03	23,469	0.05
02040105140	26,477	27,498	0.10	28,356	0.09	29,347	0.10
02040105150	66,819	67,955	0.11	68,896	0.09	69,843	0.09
02040105160	25,712	26,096	0.04	26,598	0.05	27,101	0.05
Totals	**241,664**	**249,921**	**0.83**	**257,140**	**0.72**	**264,871**	**0.77**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.1.4 identifies the remaining water available for depletive/consumptive (D/C) uses (in MGD) for unconfined groundwater/unregulated surface water supplies in each of the 19 HUC11 watersheds in WMA 1 based on three different scenarios -- 1998-2007 demands, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses, and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive. Please be advised for the purpose of this summary, water availability values have been "grayed" out in the HUC11 watersheds that are wholly located in the Highlands Region as the Highlands Regional Master Plan (HRMP) presents availability values for these areas by HUC14 sub-watershed.

Table A.1.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040104090	Shimers Brook / Clove Brook	1.0	0.6	0.3	0.5	0.5	0.3
02040104110	Walpack Bend / Montague Riverfront	0.6	0.0	0.5	0.1	0.5	0.5
02040104130	Little Flat Brook	0.6	0.0	0.6	0.0	0.5	0.5
02040104140	Big Flat Brook	1.1	0.0	1.0	0.1	1.0	1.0
02040104150	Flat Brook	0.6	0.0	0.6	0.0	0.6	0.6
02040104240	Van Campens Brook / Dunnfield Creek	0.9	0.0	0.9	0.0	0.8	0.9
02040105030	Trout Brook / Swartswood Lake	1.0	0.1	0.9	0.1	0.9	0.9
02040105040	Paulins Kill (above Stillwater Village)	3.8	1.6	2.3	2.8	1.0	2.1
02040105050	Paulins Kill (below Stillwater Village)	3.4	0.2	3.2	0.6	2.8	3.1
02040105060	Stony Brook / Delawanna Creek	0.7	0.1	0.6	0.2	0.5	0.5
02040105070	Pequest River (above/including Bear Swamp)	2.5	1.6	0.9	3.5	**-1.0**	0.7
02040105080	Bear Creek	0.7	0.2	0.6	0.3	0.5	0.6
02040105090	Pequest River (below Bear Swamp)						
02040105100	Beaver Brook	1.1	0.2	0.9	1.4	**-0.3**	0.9
02040105110	Pophandusing Brook / Buckhorn Creek						
02040105120	Lopatcong Creek						
02040105140	Pohatcong Creek						
02040105150	Musconetcong River (above Trout Brook)						
02040105160	Musconetcong River (below/including Trout Brook)						
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

1) *New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.*
2) *The significance of "losses" is explained in more detail under Section 6 below.*

5) Water Supply Status (Resource Availability)

Table A.1.5 identifies the total resource availability associated with WMA 1. Resource availability is calculated based on estimated water demands under three scenarios: based on 1998-2007 demands, at full allocation (based on DEP permit approvals), and as projected for 2020.

Table A.1.5 WMA 1 (Upper Delaware) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	30	6	23	2.3
confined groundwater	--	--	--	--
sum:	30	6	23	2.3

WMA 1 2020 Demand and Availability	
current remaining availability	23 mgd
potable use increase by 2020	4.2 mgd
2020 remaining available water	19 mgd

WMA 1 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	0.6 mgd
unbuilt water supply projects	0 mgd

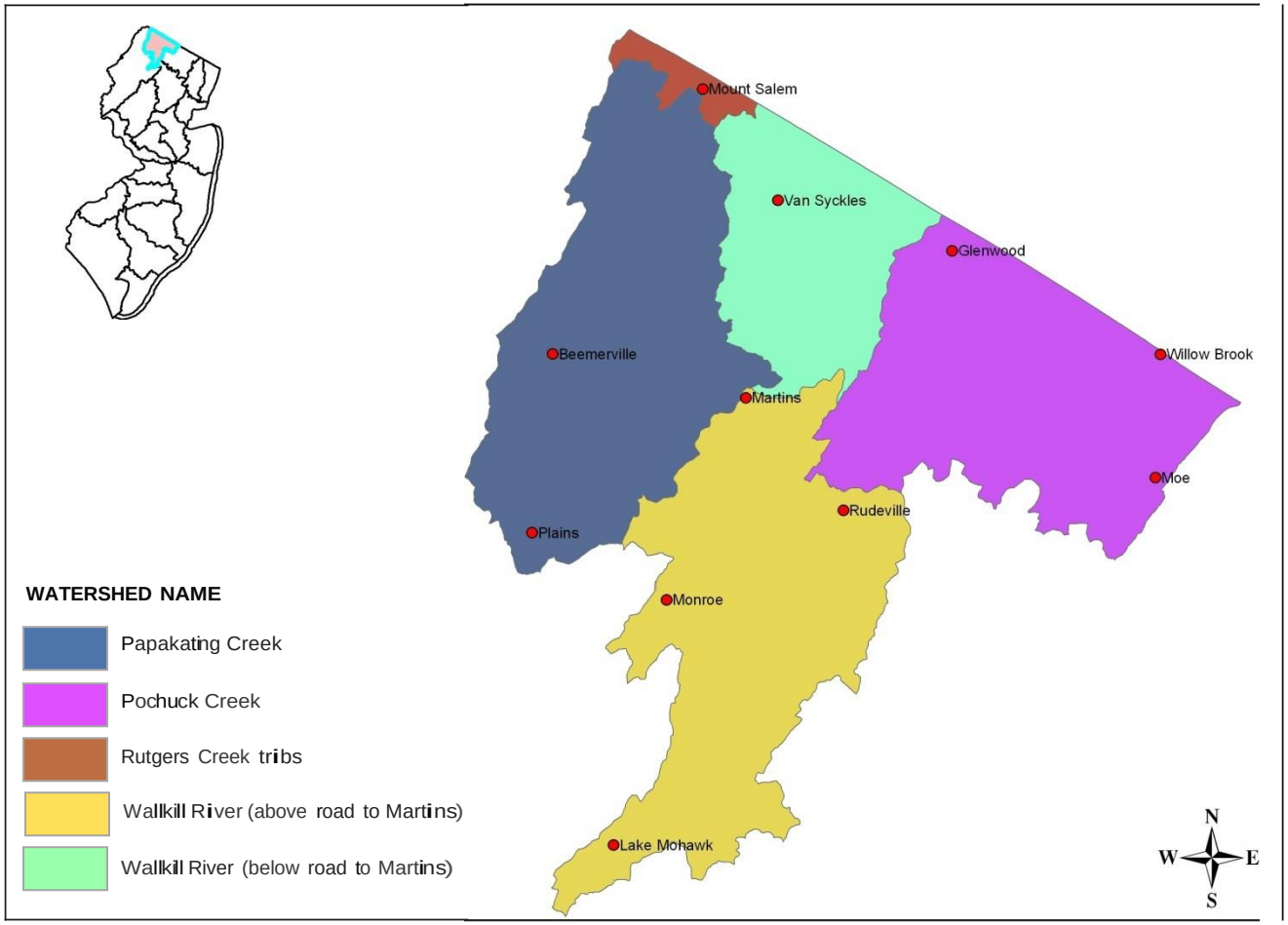
6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

As shown in *Table A.1.4*, of the 19 HUC11 watersheds within WMA 1, the Upper Pequest River and Beaver Brook HUC11's are projected to be in deficit under the full allocation scenario. These predicted stresses are based on the consumptive losses associated with agricultural use at maximum levels permitted under respective Agricultural Use Certifications.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 1. This is particularly important for the Upper Pequest River and Beaver Brook HUC11 watersheds.
- The State of New Jersey should retain the previously acquired Hackettstown Reservoir properties, and the Department should continue to reevaluate the feasibility of developing the site as a future capital water supply project (Policy Item # 4).
- For HUC11 watersheds that are located wholly within the Highlands Region, please refer to the Highlands Regional Master Plan at http://www.nj.gov/njhighlands/master/

Watershed Management Area 2: Wallkill



Recommended Initiatives for Watershed Management Area 2: Wallkill

1) Description of Planning Area

Watershed Management Area (WMA) 2 (Wallkill River) is located within the Valley and Ridge and Highlands physiographic provinces and encompasses approximately 263 square miles. WMA 2 includes 11 municipalities in Sussex County and a small portion of Passaic County. WMA 2 has a variety of different land uses including rural and centralized residential development, agriculture, commercial, recreational and industrial. WMA 2 is formed by five HUC11 watersheds: the Upper Wallkill River Lower Wallkill River, Pochuck Creek, Papakating Creek and Rutgers Creek Tributaries.

The Wallkill River Watershed is unique in that its headwater begins at Lake Mohawk in Sparta Township and then flow north into New York, eventually emptying into the Hudson River.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 2 are derived from unconfined groundwater and surface water sources. Within WMA 2, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 21.83 MGD, of which approximately 43% was diverted from unconfined groundwater and 57% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater = 9.25 MGD
Surface Water = 1.58 MGD
Regulated Surface Water = 11 MGD[2]

[2] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.2.1

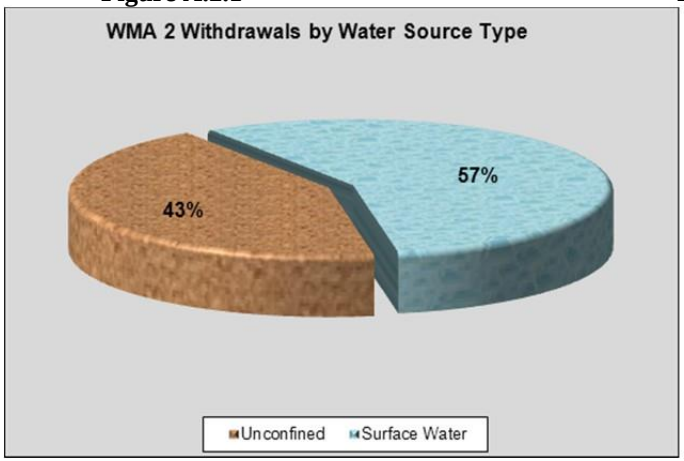
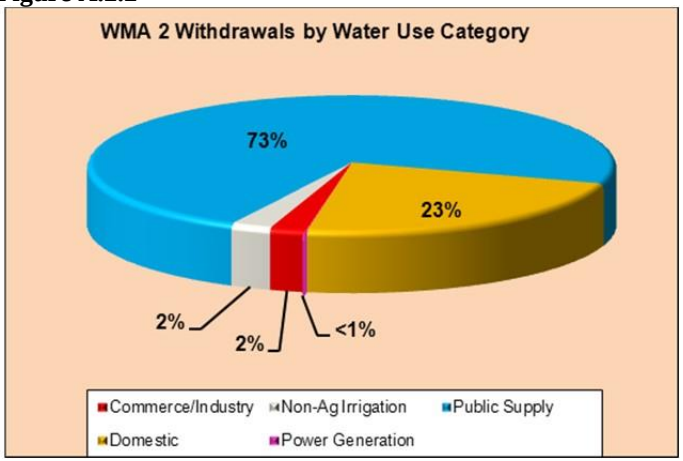


Figure A.2.2



There are five water user types within WMA 2: commerce/industry/mining, non-agricultural irrigation, public supply, domestic supply, and power generation. Withdrawals by water user category in WMA 2 are as follows: public supply – 15.96 MGD (56% surface water and 44% unconfined groundwater); domestic supply – 4.85 MGD (100% unconfined groundwater); commerce/industry/mining – 0.47 MGD (100% unconfined groundwater); non-agricultural irrigation – 0.53 MGD (61% unconfined groundwater and 39% surface water); and power generation – 0.01 MGD (100% unconfined groundwater). Refer to Figures A.2.1. and A.2.2. Note that power generation is considered 100% non-consumptive and does not contribute to reduced water availability.

Identification of Public Community Water System's Sources

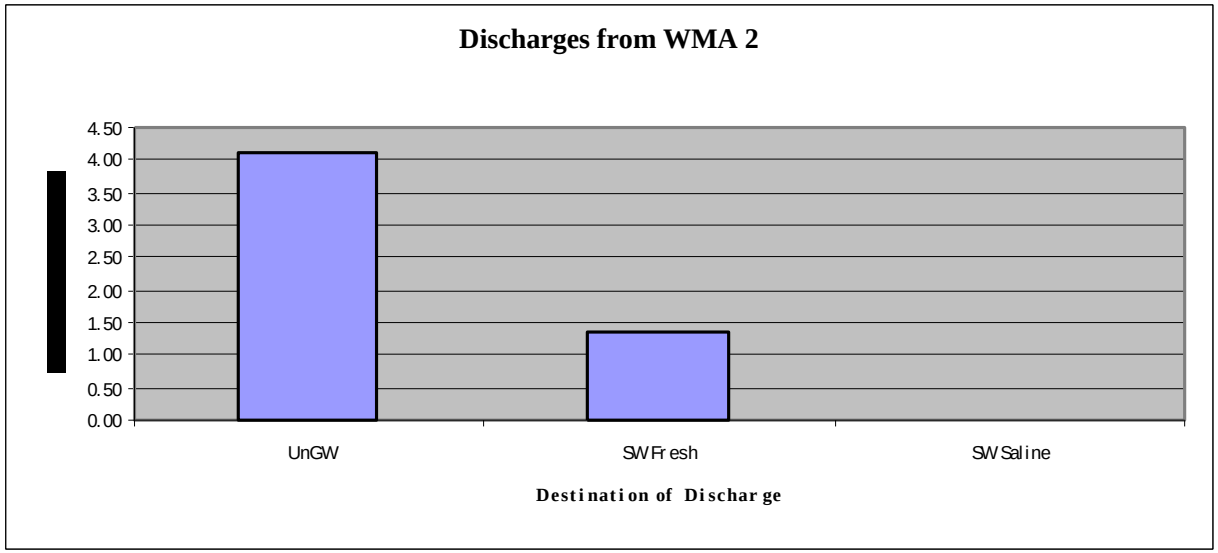
Table A.2.1 lists the purveyors who serve 1,000 people or more and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 2. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.2.3.

Table A.2.1

Purveyor	Wallkill River (above	Papakating	Pochuck Creek
Franklin Board of Public Utilities	U/S		
Hamburg Board of Public Utilities	U		
Hardyston Township MUA	U		
Lake Tamarack Water Company	U		
Mountain Creek Resort			U
Newton Water & Sewer Utility	S		
Ogdensburg Water Department	U		
Sparta Township Water Utility –	U		
Sparta Township Water Utility –	U		
Sparta Township Water Utility –	U		
Sussex Water Department		S	
United Water NJ – Vernon Valley		U	
Wallkill Water Company	U		

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.2.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.2.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 2:

Table A.2.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02020007000	Rutgers Creek tribs	472	500	528	550	573	611
02020007010	Wallkill River (above road to Martins)	26,500	28,515	30,551	32,627	34,707	35,432
02020007020	Papakating Creek	11,276	11,912	12,555	13,131	13,710	14,476
02020007030	Wallkill River (below road to Martins)	6,794	7,282	7,770	8,110	8,456	8,767
02020007040	Pochuck Creek	18,724	20,264	21,610	22,543	23,509	23,981
WMA 2 Total Population		**63,766**	**68,473**	**73,014**	**76,961**	**80,955**	**83,267**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.2.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.2.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02020007000	528	550	0.00	573	0.00	611	0.00
02020007010	30,551	32,627	0.21	34,707	0.21	35,432	0.07
02020007020	12,555	13,131	0.06	13,710	0.06	14,476	0.08
02020007030	7,770	8,110	0.03	8,456	0.03	8,767	0.03
02020007040	21,610	22,543	0.09	23,509	0.10	23,981	0.05
Totals	**73,014**	**76,961**	**0.39**	**80,955**	**0.40**	**83,267**	**0.23**

4) Available Water for Depletive/Consumptive Uses - Unconfined Groundwater/Unregulated Surface Water (Use, Full Allocation and 2020)

Table A.2.4 identifies the remaining water available for depletive/consumptive (D/C) uses (MGD) for unconfined ground water/unregulated surface water supplies in each of WMA 2's five HUC11 watersheds based on three different scenarios -- 1998-2007 demands), full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive. Please be advised for the purpose of this summary, water availability values have been "grayed" out in the HUC11 watersheds that are wholly located in the Highlands as the Highlands Regional Master Plan (HRMP) presents availability values for these areas by HUC14 sub-watershed.

Table A.2.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Use in 2020 (MGD)
02020007000	Rutgers Creek tribs	0.1	0.0	0.1	0.0	0.1	0.1
02020007010	Wallkill River (above road to Martins)	2.1	1.8	0.3	4.1	**-2.0**	**-0.1**
02020007020	Papakating Creek	1.2	1.0	0.2	1.8	**-0.5**	0.2
02020007030	Wallkill River (below road to Martins)	0.8	0.6	0.2	0.6	0.2	0.1
02020007040	Pochuck Creek						
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

3) *New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.*
4) *The significance of "losses" is explained in more detail under Section 6 below.*

5) Water Supply Status (Resource Availability)

Table A.2.5 identifies the total resource availability associated with WMA 2. In addition, the table shows the 1998-2007 demands, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 2 based on each of these three demand scenarios.

Table A.2.5 WMA 2 (Walkill) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	8	4	4	-4.5
confined groundwater	--	--	--	--
sum:	8	4	4	-4.4

WMA 2 2020 Demand and Availability	
current remaining availability	4 mgd
potable use increase by 2020	1.7 mgd
2020 remaining available water	2 mgd

WMA 2 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	0.3 mgd
unbuilt water supply projects	--

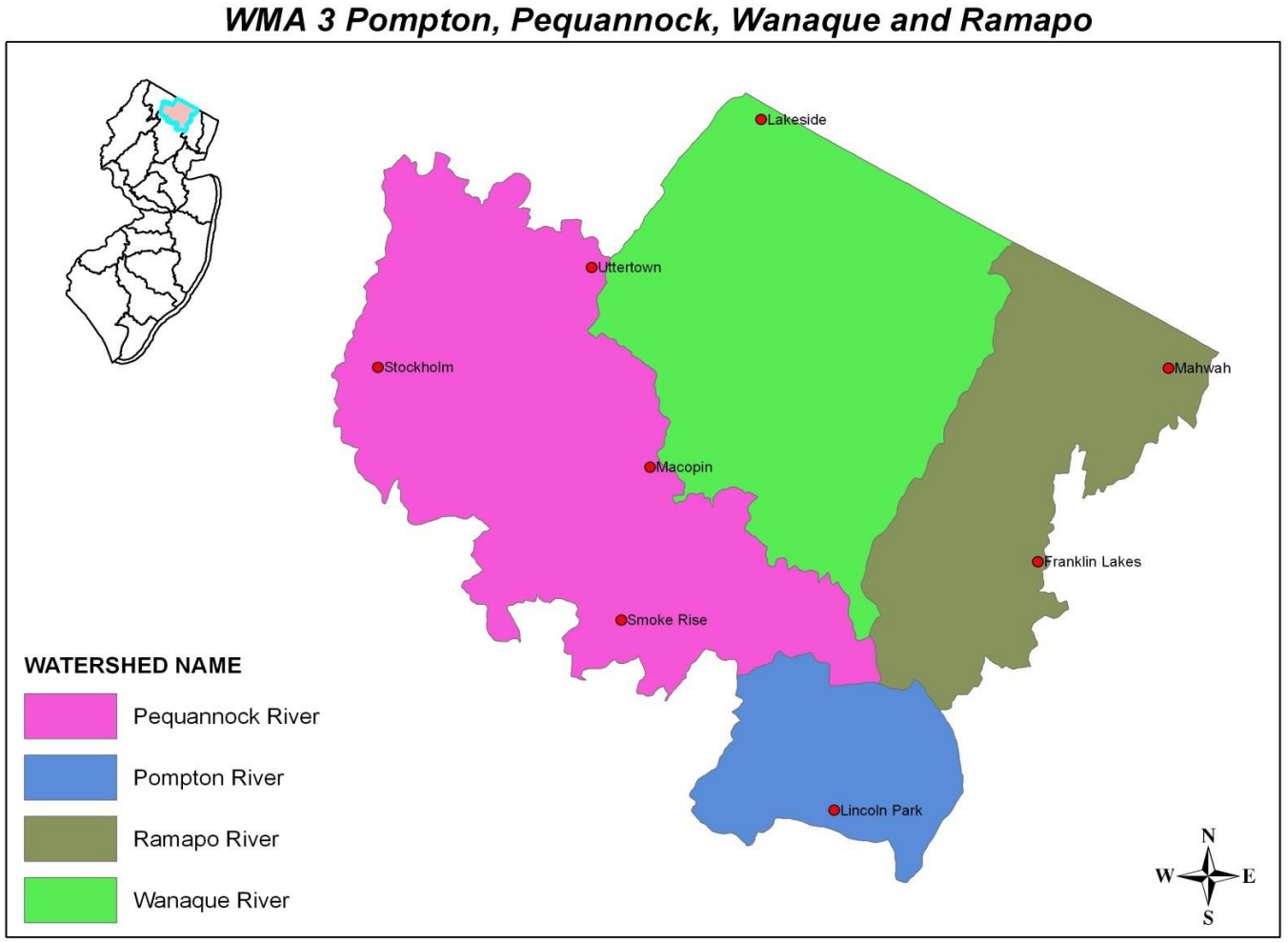
6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

As shown in *Table A.2.4*, the Upper Wallkill and Papakating Creek HUC11 watersheds are projected to be in deficit under the full allocation scenario. The predicted stress in the Upper Wallkill River HUC11 watershed is due to the diversion of potable supplies from Lake Morris by the Newton Water & Sewer Utility and subsequent transfer to the Newton Borough in the Upper Paulins Kill HUC11 watershed (WMA 1). The predicted stress in the Papakating Creek HUC11 watershed is a result of the consumptive losses associated with agricultural certifications under the full allocation scenario. Also, the largest wastewater export, which is a depletive loss, is from the Pochuck Creek HUC11 watershed (via discharge from the Sussex County Municipal Utility Authority) to the Upper Wallkill River HUC11 watershed. This loss should continue to be monitored.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3 for all agricultural facilities located in WMA 2. This is particularly important for the Papakating Creek HUC11 watershed.
- NJDEP will continue to monitor the Upper Wallkill River and Papakating Creek HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
  - If a deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
  - Types of mitigation include: the permanent removal/reduction of an existing depletive/consumptive use, increased storage or increased recharge.
- For HUC11 watersheds that are located wholly within the Highlands, please refer to the HRMP at http://www.nj.gov/njhighlands/master/.

Watershed Management Area 3: Pompton, Pequannock, Wanaque and Ramapo



Recommended Initiatives for Watershed Management Area 3: Pompton, Pequannock, Wanaque and Ramapo

1) Description of Planning Area

Watershed Management Area (WMA) 3 is located in the Highlands physiographic province of New Jersey, and includes four HUC11 watersheds: Pompton, Ramapo, Pequannock and Wanaque River. WMA 3 lies predominantly in Passaic County but also extends into parts of Bergen, Morris and Sussex Counties. The Pequannock, Wanaque and Ramapo Rivers all flow into the Pompton River. The Pompton River is, in turn, a major tributary to the Upper Passaic River. WMA 3 is 378.6 square miles and includes some of the State's major water supply reservoir systems, including the Wanaque and Monksville Reservoirs as well as several reservoirs that serve the City of Newark.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 3 are derived from unconfined groundwater and surface water sources. Within WMA 3, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 2,611.63 MGD, of which 1% was diverted from unconfined groundwater and 99% from surface water. The daily water use volume breakdown is as follows:

Surface Water = 0.07 MGD
Unconfined groundwater = 25.73 MGD
Regulated Surface Water = 2,585.90 MGD[3]

[3] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water

Figure A.3.1

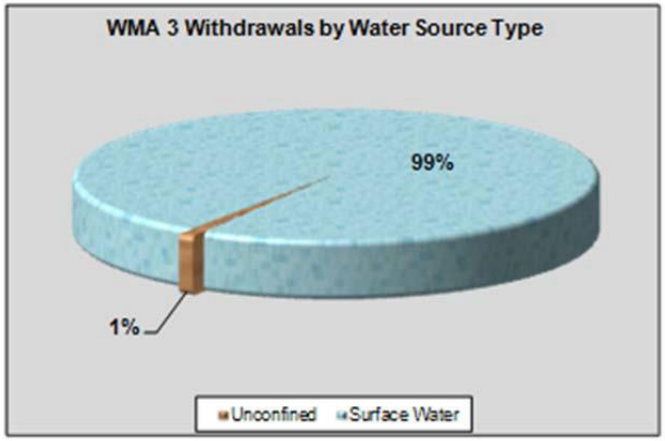
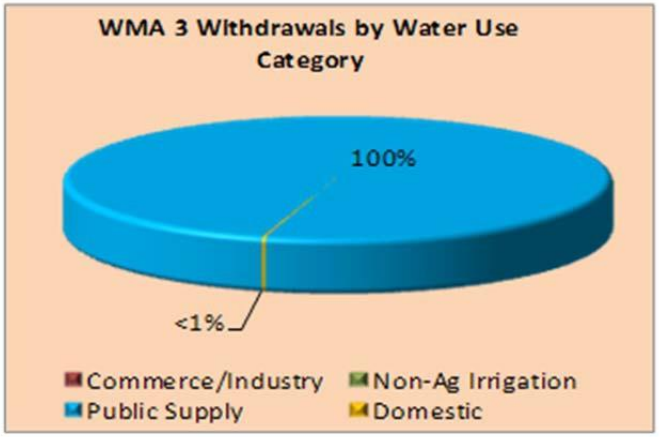


Figure A.3.2



There are four water user types within WMA 3 (i.e. commerce/industry/mining, non-agricultural irrigation, public supply, and domestic supply). Withdrawals by water use category in WMA 3 are as follows: public supply – 2606.35 MGD (99% surface water and 1% unconfined groundwater); domestic supply – 4.86 MGD (100% unconfined groundwater); commerce/ industry/mining — 0.21 MGD (100% unconfined groundwater); and non-agricultural irrigation — 0.18 MGD (78% unconfined groundwater and 22% surface water). Refer to Figures A.3.1 and A.3.2.

As indicated above, the main use of water diverted from WMA 3 is for potable water supplies; however, only a small portion of the water diverted in WMA 3 is utilized here as the majority of diverted water is exported to WMAs 4, 5 and 7.

Identification of Public Community Water System's Sources

Table A.3.1 shows purveyors that serve a population equal to or greater than 1,000 people and has a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 3. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.3.3.

Table A.3.1

Purveyor	Pequannock	Wanaque	Ramapo River	Pompton River
Butler Water Department	S			
Jefferson Twp. Water Utility –	U			
Mahwah Water Department			U	
Montville Twp. MUA				U
N.J.D.W.S.C. – Wanaque North System		S		
Newark Water Department	S			
Oakland Water Department			U	
Pequannock Twp. Water Department	U			U
Pompton Lakes Water Department	U	U		
Ramsey Water Department			U	
Ringwood Water Department		U		
Riverdale Boro Water Department	U			
United Water NJ Franklin Lakes			U	S
United Water NJ –		U		
West Milford Twp. - Bald Eagle		U		
Wanaque Water Department		U		
Wayne Twp. Division of Water			U	
West Milford Twp. MUA - Old Milford	U	U		

For deficit/surplus information pertaining to these individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Withdrawal Trends of Major Safe Yield Based Water Systems with Surface Water Withdrawals within WMA 3

Two of the State's largest surface water systems are located in WMA 3. Those systems are the North Jersey District Water Supply Commission (NJDWSC)) and the City of Newark, with safe yields of 173 MGD and 49.1 MGD, respectively. The NJDWSC provides finished surface water to Newark, Kearney, Bayonne, Wayne, Bloomfield, Montclair, Cedar Grove, Nutley and Glen Ridge and the Passaic Valley Water Commission (PVWC). PVWC is owned by the Cities of Paterson, Clifton, and Passaic, each of whom has an allotment of supply from NJDWSC. In addition, NJDWSC delivers raw water to United Water New Jersey in Bergen County.

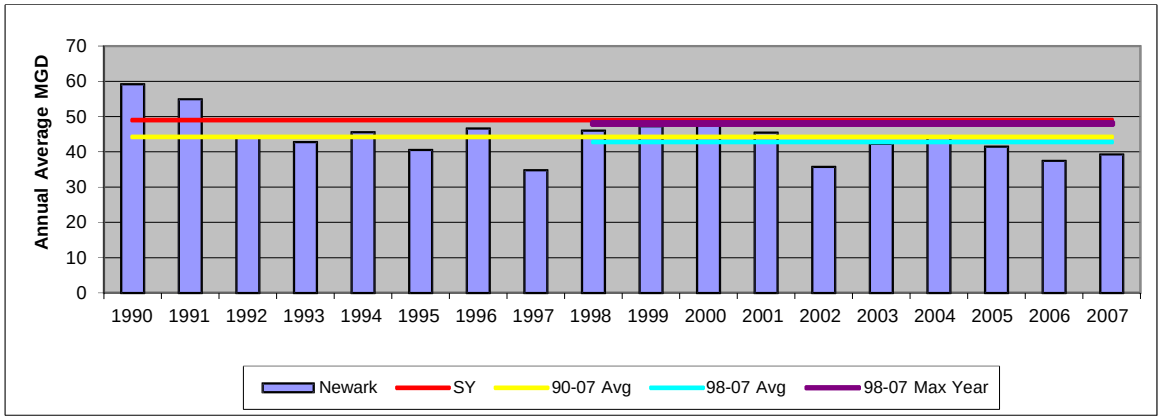
Aside from NJDWSC, the City of Newark's water system lies within the Pequannock River HUC11 watershed. In addition to their own water demands, the City of Newark also provides bulk water to the communities of Elizabeth, Belleville, Nutley, Bloomfield, Pequannock, Wayne and East Orange. Newark also sells small amounts of water on a wholesale basis to the Essex County Utilities Authority and to New Jersey American Water – Elizabethtown.

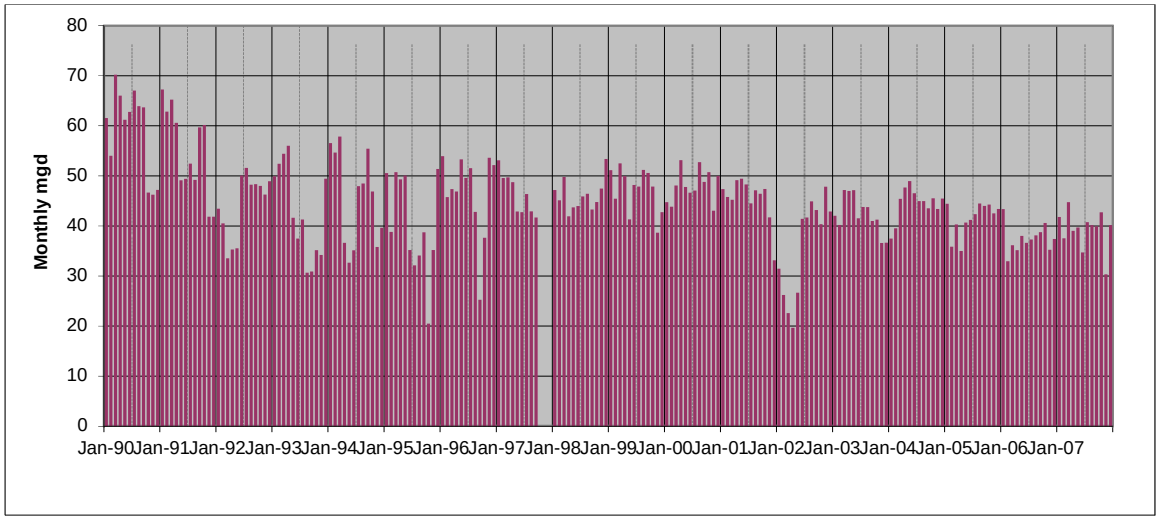
City of Newark

PWSID: 0714001

Safe Yield (mgd): 49

90-07 Annual Average Use: 44.2	**Unused Safe Yield: 4.8**
98-07 Annual Average Use: 42.8	**Unused Safe Yield: 6.2**
98-07 Maximum Year Use: 48.0	**Unused Safe Yield: 1.0**





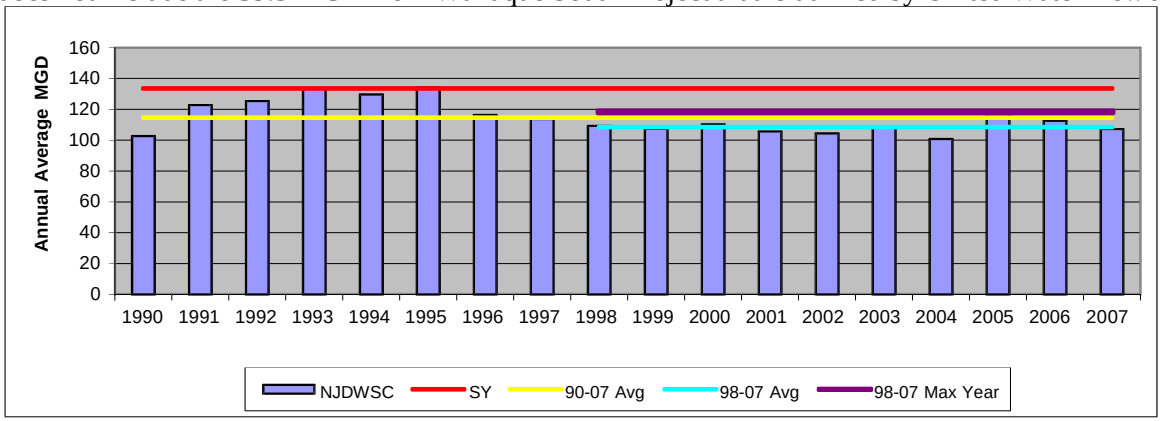
North Jersey District Water Supply Commission

PWSID: 1613001

Safe Yield (mgd): 133.5*

90-07 Annual Average Use:	**114.6**	**Unused Safe Yield:**	**18.9**
98-07 Annual Average Use:	**108.5**	**Unused Safe Yield:**	**25.0**
98-07 Maximum Year Use:	**118.4**	**Unused Safe Yield:**	**15.1**

*does not include the 39.5 MGD from Wanaque South Project that is utilized by United Water New Jersey



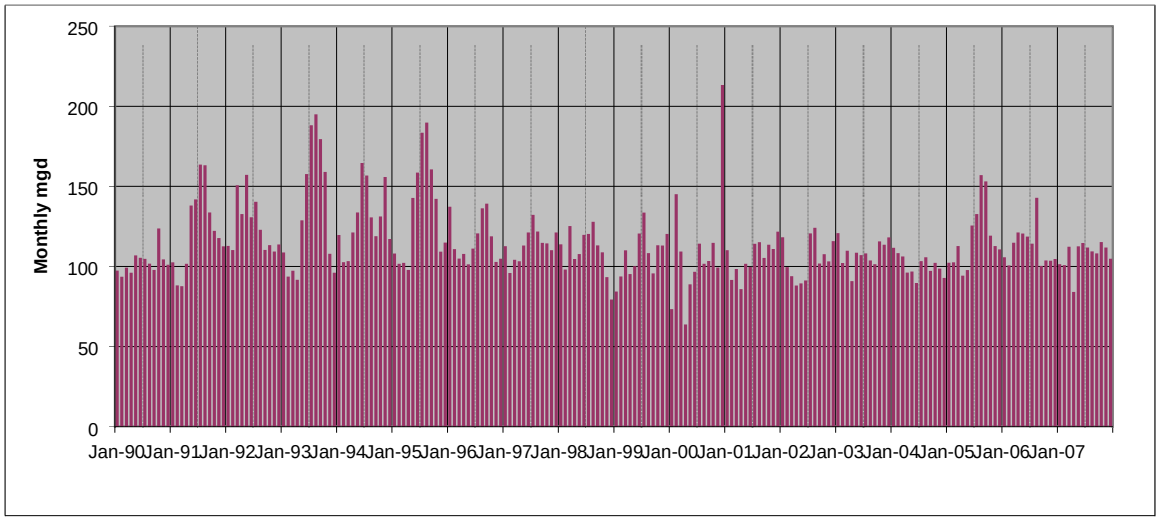
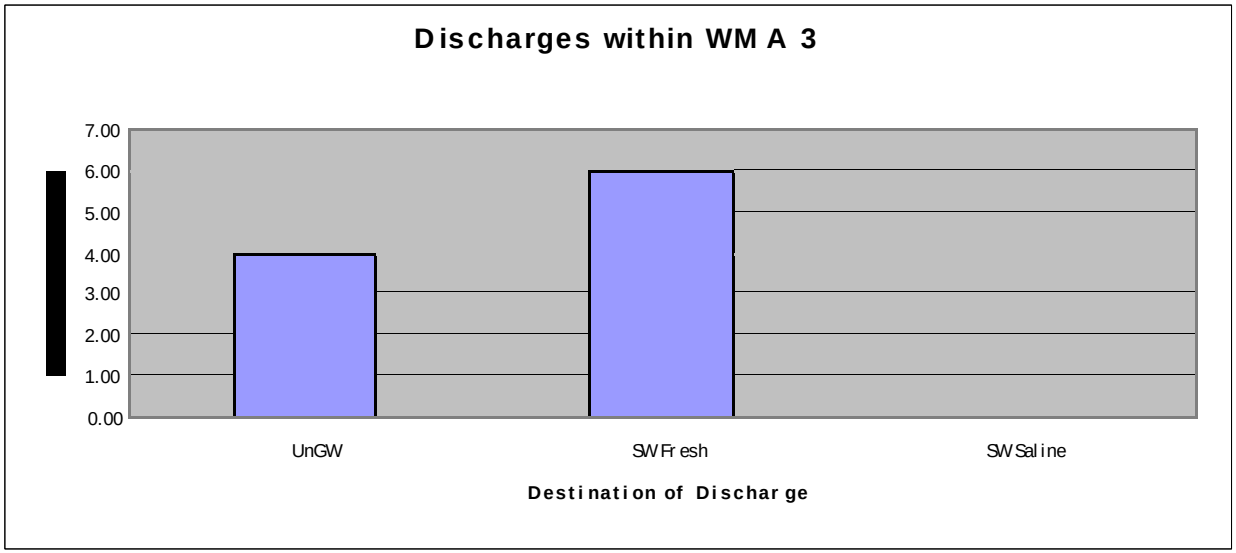


Figure A.3.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.3.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 3:

Table A.3.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030103050	Pequannock River	45,579	48,375	49,326	50,430	52,037	53,682
02030103070	Wanaque River	41,625	43,602	43,960	44,446	45,316	46,538
02030103100	Ramapo River	64,398	67,606	68,119	68,862	70,802	72,297
02030103110	Pompton River	40,251	41,499	41,908	42,514	43,147	44,006
WMA 3 Total Population		**191,853**	**201,082**	**203,313**	**206,252**	**211,302**	**216,523**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.3.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.3.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030103050	49,326	50,430	0.11	52,037	0.16	53,682	0.16
02030103070	43,960	44,446	0.05	45,316	0.09	46,538	0.12
02030103100	68,119	68,862	0.07	70,802	0.19	72,297	0.15
02030103110	41,908	42,514	0.06	43,147	0.06	44,006	0.09
Totals	**203,313**	**206,252**	**0.29**	**211,302**	**0.50**	**216,523**	**0.52**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water (Use, Full Allocation and 2020)

Table A.3.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of WMA 3's four HUC11s based on three different scenarios -- 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive. Please be advised for the purpose of this summary, water availability values have been "grayed" out in the HUC11 watersheds that are wholly located in the Highlands as the Highlands Regional Master Plan (HRMP) presents availability values for these areas by HUC14 sub-watershed.

Table A.3.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030103050	Pequannock River						
02030103070	Wanaque River						
02030103100	Ramapo River	4.2	8.8	-4.6	11.2	-7.0	-4.8
02030103110	Pompton River	0.9	-0.6	1.5	1.3	-0.4	1.4
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

- *New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.*
- *A negative value in a loss column indicates a "gain" to the HUC11 watershed.*
- *The significance of "losses" is explained in more detail under Section 6 below.*

5) Water Supply Status (Resource Availability)

Table A.3.5 identifies the total resource availability associated with WMA 3. In addition, the table shows the (based on 1998-2007 data), full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 3 for each of these three demand scenarios.

Table A.3.5 WMA 3 (Pompton, Pequannock, Wanaque and Ramapo) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	187	168	19	0
run-of-the-river intakes and unconfined groundwater	12	13	-1	-7.7
confined groundwater	--	--	--	--
sum:	199	181	18	-7.7

WMA 3 2020 Demand and Availability	
current remaining availability	18 mgd
potable use increase by 2020	1.9 mgd
2020 remaining available water	16 mgd

WMA 3 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	0.9 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

The Ramapo River HUC11 watershed appears stressed primarily because approximately 85% of the wastewater generated in this watershed is exported in the form of surface water discharges, which is considered to be a depletive use. In addition, the watershed statistics for the Ramapo include areas that are outside of New Jersey boundaries (i.e. within New York). While the streamflow statistics include the New York portion of the basin, the amounts of depletive/consumptive uses from the New York portion of the basin were not quantified due to a lack of data. These missing data, if included in the analysis, could inflate the deficit in the Ramapo HUC11 watershed.

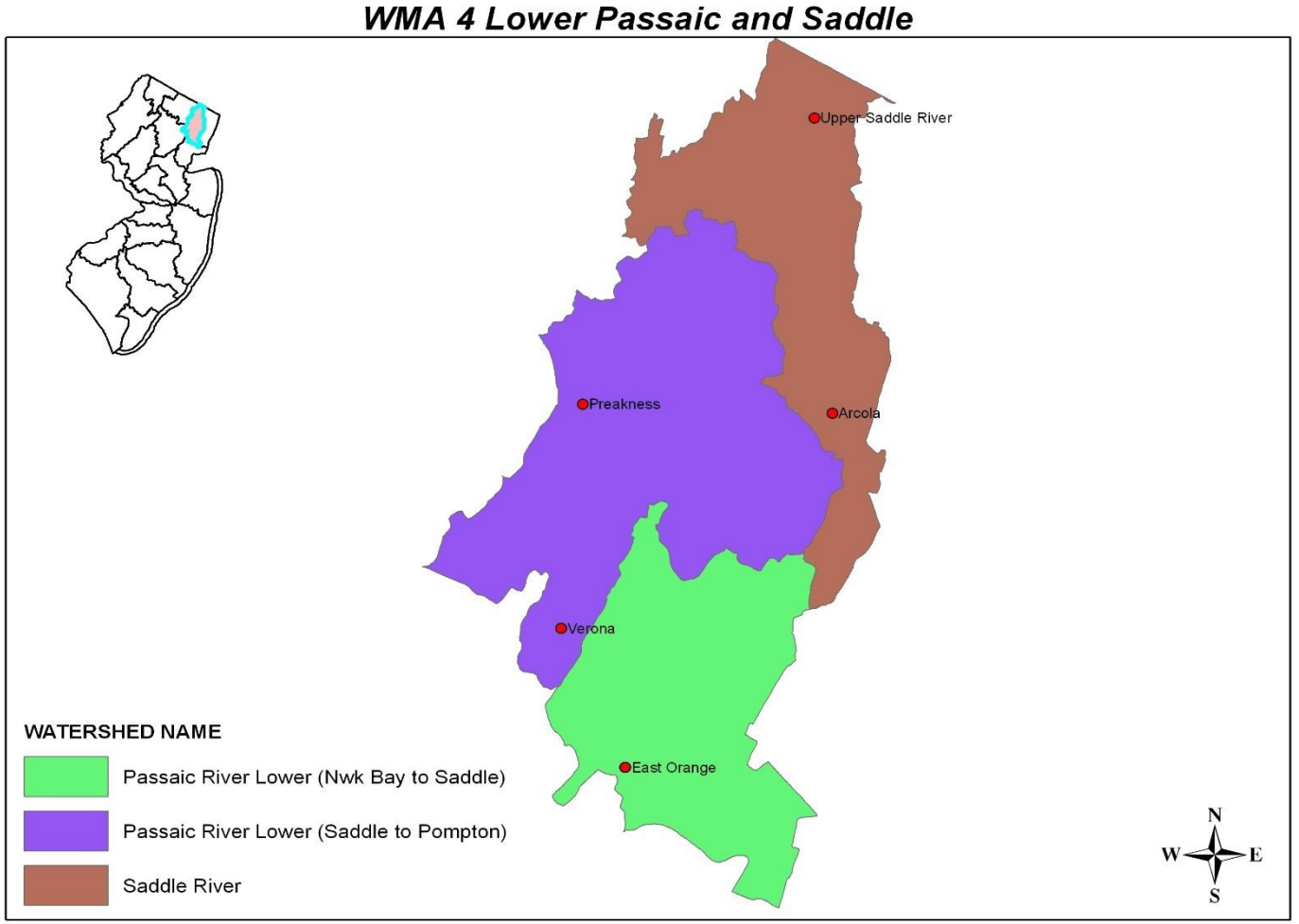
7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Ramapo River HUC11 watershed will be evaluated prior to Department approvals associated with future water supply and wastewater decisions. If a deficit continues, additional depletive/consumptive uses should be offset through mitigation, which includes: permanent removal/reduction of an existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Pompton River HUC11 watershed as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-

2007" in coordination with stakeholders.

- Consider utilization of unused existing safe yield from NJDWSC and/or Newark to offset existing and/or potential future depletive/consumptive losses associated with unconfined groundwater uses.
- Continue to coordinate with New York Department of Environmental Conservation (NJDEC) and other applicable agencies to address depletive/consumptive activities upstream of this WMA that would affect the sustainability of New Jersey's water resources.
- For HUC11 watersheds that are located wholly within the New Jersey Highlands, please refer to the HRMP at http://www.nj.gov/njhighlands/master/.

Watershed Management Area 4: Lower Passaic and Saddle



Recommended Initiatives for Watershed Management Area 4: Lower Passaic and Saddle

1) Description of Planning Area

Watershed Management Area (WMA) 4 is located in the Piedmont physiographic province, and consists of three HUC11 watersheds: Lower Passaic River (Saddle to Pompton), Saddle River and Lower Passaic River (Newark Bay to Saddle). The WMA 4 drainage area is approximately 196.4 square miles and is spread across parts of Passaic, Bergen, Essex and Hudson Counties in the northeastern corner of New Jersey.

The major tributaries to the Lower Passaic River are the Saddle River, Preakness Brook, Second River and Third River, with the Saddle River being the largest. The Saddle River HUC11 Watershed has a drainage area of approximately 59.5 square miles which also includes area (headwaters) that extends into New York State. WMA 4 is extensively developed and includes many older cities and industrial centers including Newark, Paterson, Clifton and East Orange.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 4 are derived from unconfined groundwater and surface water sources. Within WMA 4, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 633.07 MGD, of which 6% was diverted from unconfined groundwater and 94% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater = 40.30 MGD
Surface Water = 100.77 MGD
Regulated Surface Water = 492 MGD[4]

[4] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safeyield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.4.1

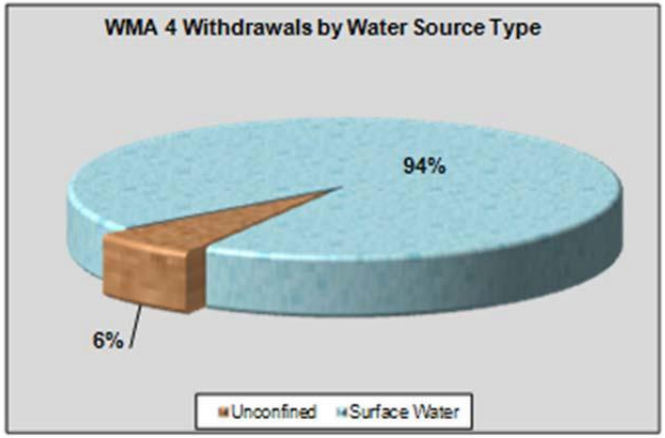
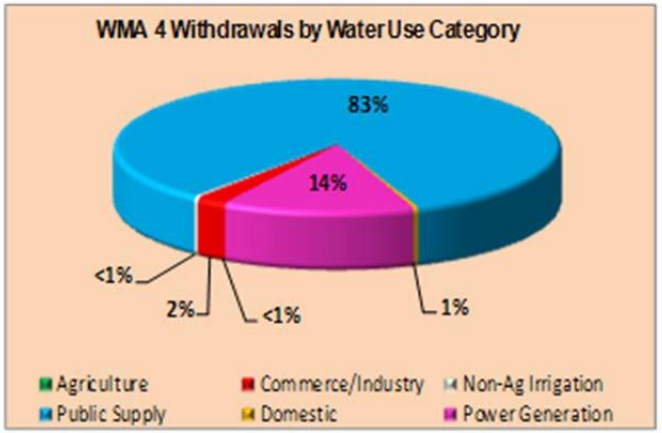


Figure A.4.2



All six water user categories (agriculture, commerce/industry/mining, non-agricultural irrigation, public supply, domestic supply, and power generation) are represented in WMA 4. Withdrawals by water category in WMA 4 are as follows: public supply – 526.37 MGD (94% from surface water and 6% unconfined groundwater); domestic supply – 2.36 MGD (100% unconfined groundwater); agriculture – 0.01 MGD (100% unconfined groundwater); commerce/industry/mining sector – 14.7 MGD (79% surface water and 21% unconfined groundwater), non-agricultural irrigation – 2.11 MGD (84% unconfined groundwater and 16% surface water); and power generation – 87.51 MGD (100% surface water). Refer to Figures A.4.1 and A.4.2. Note that power generation is considered 100% non- consumptive and does not contribute to reduced water availability.

Identification of Public Community Water System's Sources

Table A.4.1 lists the water suppliers who serve a population of 1,000 or more individuals and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 4. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.4.3.

Table A.4.1

Purveyor	Passaic River Lower (Saddle to Pompton)	Saddle River	Passaic River Lower (Newark Bay to Saddle)
Allendale Water Department		U	
Essex County Utilities Authority	U		
Essex Fells Water Department	U		
Fair Lawn Water Department	U	U	
Fairfield Water Department	U		
Garfield Water Department	U		
Glen Ridge Water Department			U
Haledon MUA	S		
Hawthorne Water Department	U		
Ho-Ho-Kus Water Department		U	
Mahwah Water Department		U	
Montclair Water Bureau			U
Nutley Water Department			U
Orange Water Department			U
Passaic Valley Water Commission	S		
Ramsey Water Department		U	
Ridgewood Water Department	U	U	
United Water NJ		U	
Waldwick Water Department		U	
Wallington Water Department		U	U

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Withdrawal Trends of Major Safe Yield Based Water Systems with Surface Water Withdrawals within WMA 4

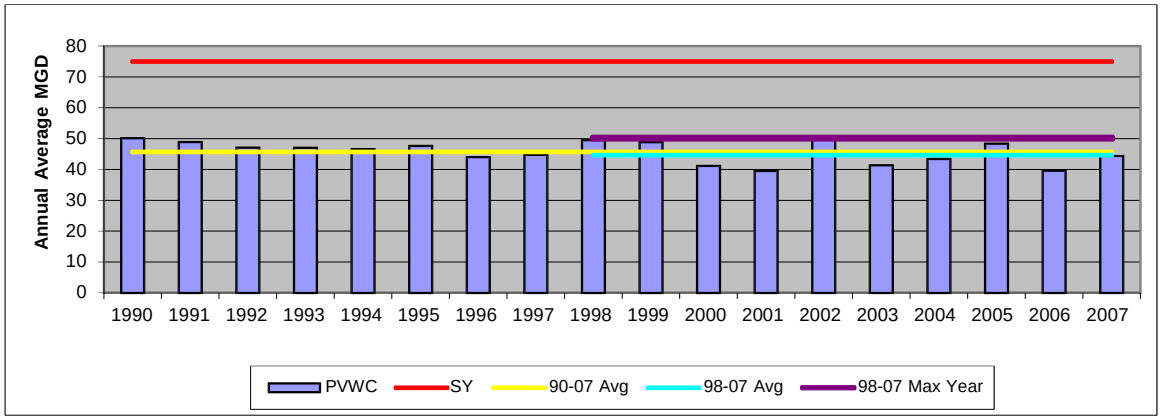
The Passaic Valley Water Commission (PVWC) is the largest provider of *surface water* for potable supply in WMA 4. PVWC provides water to Paterson, Clifton, Passaic, West Paterson, Hawthorne, Harrison, Bloomingdale, Cedar Grove, Elmwood Park, Fairfield, Fair Lawn, Garfield, Haledon, Nutley, Verona, Totowa, Lincoln Park, Lodi, North Caldwell, West Caldwell, NJAW-Little Falls, NJAW-Short Hills, North Arlington, Ringwood, Riverdale, Wallington, West Milford, and SE Morris County MUA.

Passaic Valley Water Commission

PWSID: 1605002

Safe Yield (mgd): 75

90-07 Annual Average Use:	**45.7**	**Unused Safe Yield:**	**29.3**
98-07 Annual Average Use:	**44.6**	**Unused Safe Yield:**	**30.4**
98-07 Maximum Year Use:	**50.2**	**Unused Safe Yield:**	**24.8**



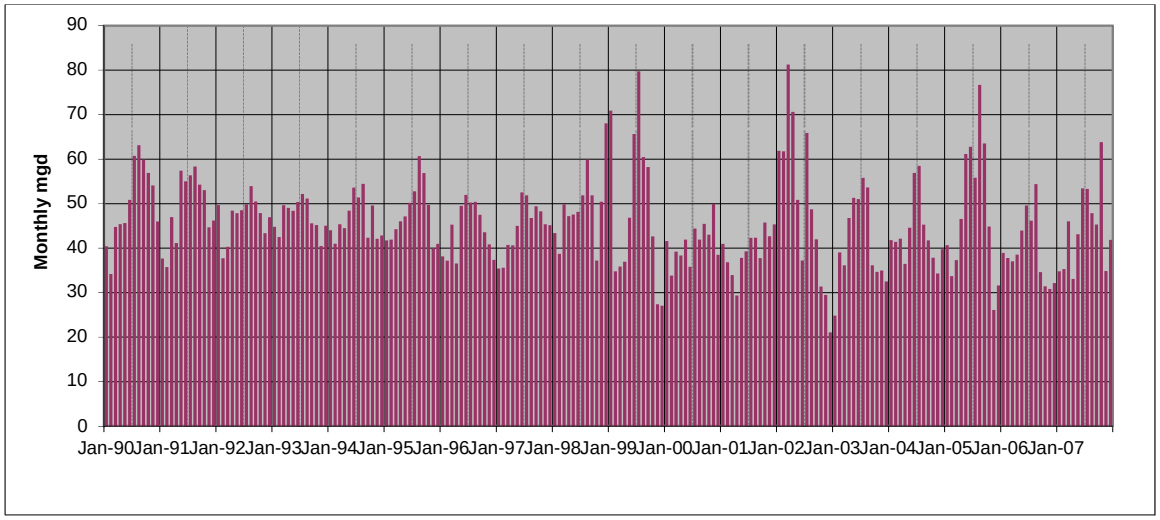
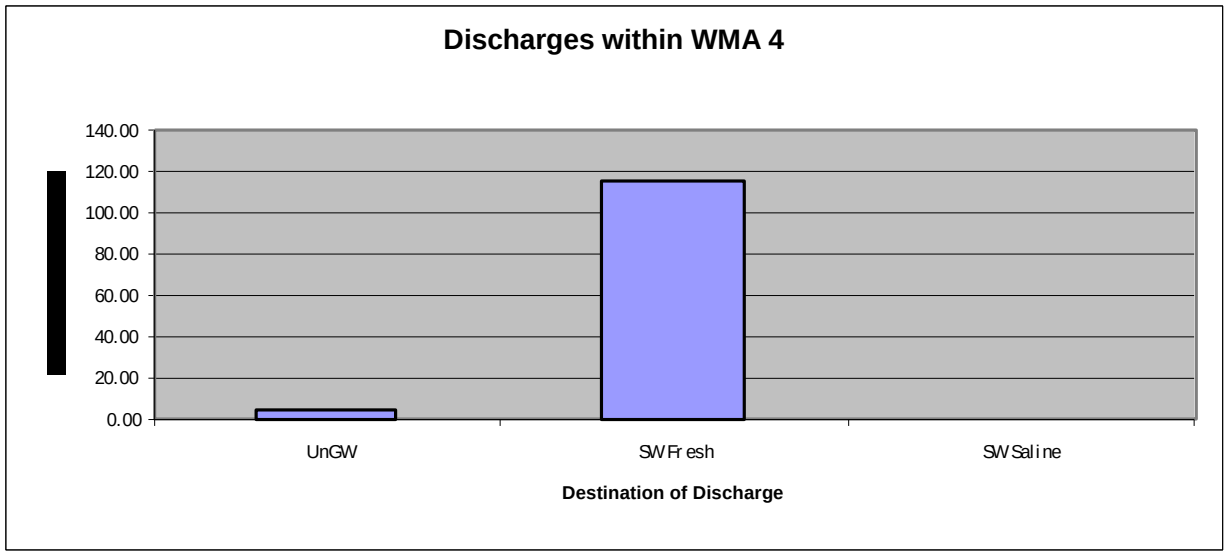


Figure A.4.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.4.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 4:

Table A.4.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030103120	Passaic River Lower (Saddle to Pompton)	471,736	478,995	486,072	495,493	514,914	537,436
02030103140	Saddle River	161,699	164,552	165,373	166,714	170,909	174,079
02030103150	Passaic River Lower (Newark Bay to Saddle)	467,288	474,411	482,067	489,323	504,066	523,110
WMA 4 Total Population		**1,100,723**	**1,117,958**	**1,133,512**	**1,151,530**	**1,189,889**	**1,234,625**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.4.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.4.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030103120	486,072	495,493	0.94	514,914	1.94	537,436	2.25
02030103140	165,373	166,714	0.13	170,909	0.42	174,079	0.32
02030103150	482,067	489,323	0.73	504,066	1.47	523,110	1.90
Totals	**1,133,512**	**1,151,530**	**1.80**	**1,189,889**	**3.83**	**1,234,625**	**4.47**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water (Use, Full Allocation and 2020)

Table A.4.4 identifies the remaining water available for depletive/consumptive uses (in MGD) for unconfined groundwater/unregulated surface water supplies in each of the three HUC11 watersheds in WMA 4 for each of the three different scenarios -- 1998-2007 uses full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive (D/C) uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.4.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020
02030103120	Passaic River Lower (Saddle to Pompton)	2.6	7.6	**-5.0**	13.1	**-10.5**	**-5.4**
02030103140	Saddle River	4.3	6.1	**-1.8**	12.7	**-8.4**	**-2.0**
02030103150	Passaic River Lower (Newark Bay to Saddle)	2.6	2.7	0.0	4.3	**-1.7**	**-0.3**
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

8) New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.

9) *The significance of "losses" is explained in more detail under Section 6 below.*

5) Water Supply Status (Resource Availability)

Table A.4.5 identifies the total resource availability associated with WMA 4. In addition, the table shows 1998-2007 demands, full allocation and estimated 2020 demands, and the corresponding remaining available water supply in WMA 4 based on these three scenarios.

Table A.4.5 WMA 4 (Lower Passaic and Saddle) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	75	50	25	0
run-of-the-river intakes and unconfined groundwater	10	16	-7	-21
confined groundwater	--	--	--	--
sum:	85	67	18	-21

WMA 4 2020 Demand and Availability

remaining availability	18 mgd
potable use increase by 2020	8.9 mgd
2020 remaining available water	9 mgd

WMA 4 Options for Additional Water Supply

ocean/bay sanitary sewer discharges	--
potable conservation savings	3.6 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

The Lower Passaic River (Saddle to Pompton) and Saddle River HUC11 watersheds appear stressed primarily as a result of the depletive exportation of wastewater to the Newark Bay/Kill Van Kull/Upper New York Bay HUC11 watershed in WMA 7. In addition, the watershed statistics for the Saddle River include areas that are outside the boundaries of New Jersey (i.e. Saddle River drainage basin in New York). While the streamflow statistics include the New York portion of the basin, the amounts of depletive/ consumptive uses from the New York portion of the basin were not quantified due to a lack of data. If these data were included with the New Jersey data, the result would likely exhibit an even greater deficit for the Ramapo HUC11 watershed.

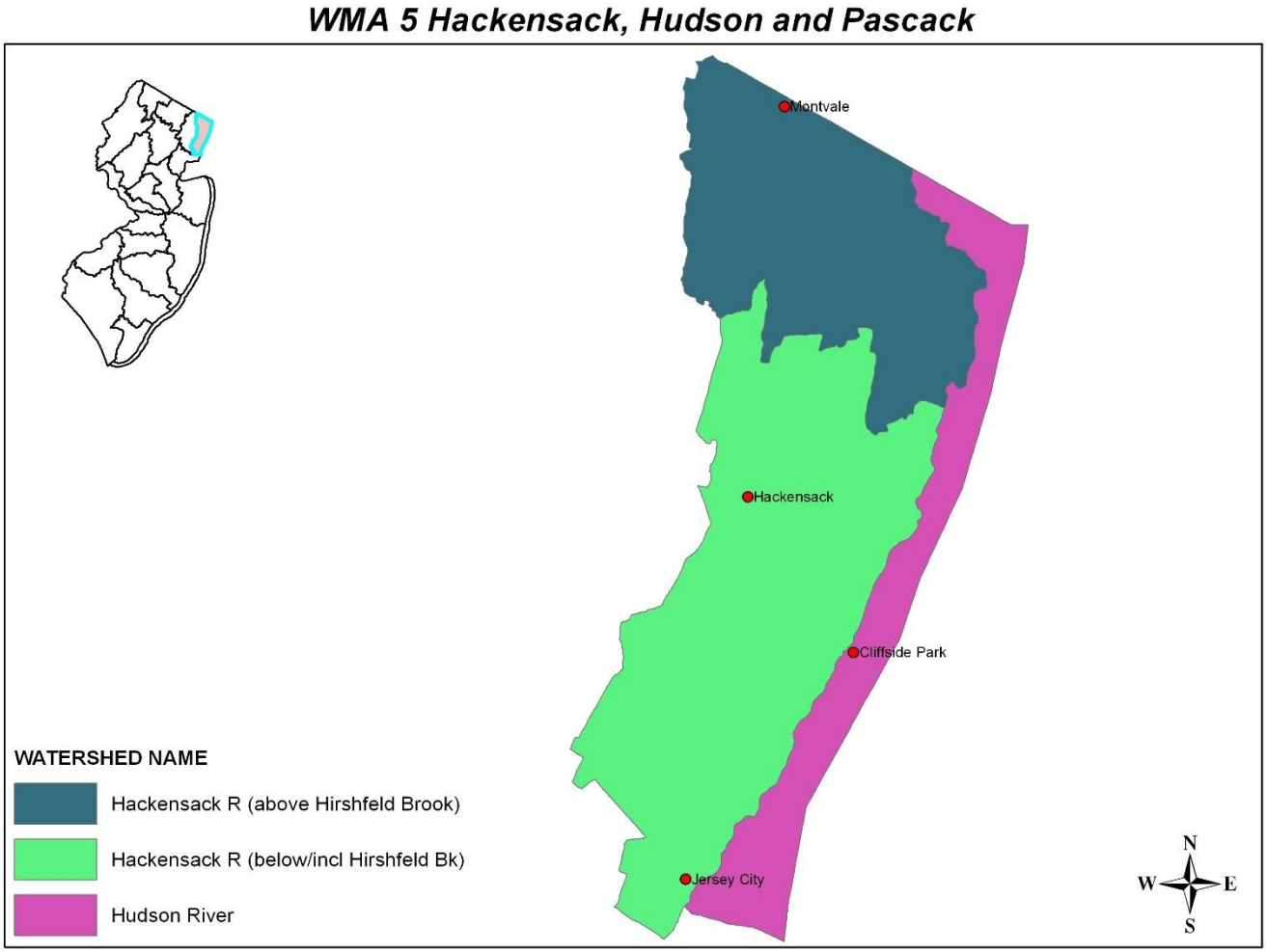
Finally, based upon known water use data submitted to the Department, the water service areas of the United Water New Jersey-Franklin Lakes along with the Ridgewood, Mahwah, Ramsey, Fairfield and Parkridge water departments have exhibited above-average outdoor water use. Even though some of these consumptive uses associated with these water service areas are of smaller magnitude, it is still a loss to the WMA and it should be carefully monitored.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Passaic River Lower (Saddle to Pompton) and Saddle River HUC11 watersheds will be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If a deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Forms of mitigation include: permanent removal/reduction of an existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Passaic River Lower (Newark Bay to Saddle) HUC11watersheds as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.

- Consider utilization of available safe yield and/or interconnections to offset existing and potential future depletive/consumptive losses associated with unconfined groundwater uses.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.
- Continue to coordinate with New York Department of Environmental Conservation (NJDEC) and other applicable agencies to address depletive/consumptive activities upstream of this WMA that would affect the sustainability of New Jersey's water resources.

Watershed Management Area 5: Hackensack, Hudson and Pascack



Recommended Initiatives for Watershed Management Area 5: Hackensack, Hudson and Pascack

1) Description of Planning Area

Watershed Management Area 5 lies mostly in Bergen County but also includes part of Hudson County. It is located in the extreme northeastern corner of New Jersey, extending from the southern New York border, where the Hackensack River enters New Jersey, to Newark Bay. WMA 5 also includes the portion of New Jersey that stretches along the Hudson River. WMA 5 is comprised of three HUC11 watersheds -- Hudson, Upper Hackensack River and Lower Hackensack River. The surface water supply sources in this planning area consist of United Water New Jersey's Lake Tappan, Woodcliff Lake, Lake Deforest and Oradell Reservoirs. For additional information pertaining to these reservoirs, please refer to Chapter 3.

Although WMA 5 is the most populous WMA in the State, approximately 50% of the land is undeveloped. This is because much of the lower Hackensack River Watershed is tidal marsh and proposed land uses are governed by the environmental standards administered by the Hackensack Meadowlands Development Commission. Thirty percent of the developed land in WMA 5 is residential while the remainder is dedicated to commercial/industrial uses.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 5 are derived from unconfined groundwater and surface water sources. Within WMA 5, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 861.97 MGD, of which 1% was diverted from unconfined groundwater and 99% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater = 6.55
MGD Surface Water = 0.42 MGD
Regulated Surface Water = 855 MGD[5]

[5] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.5.1

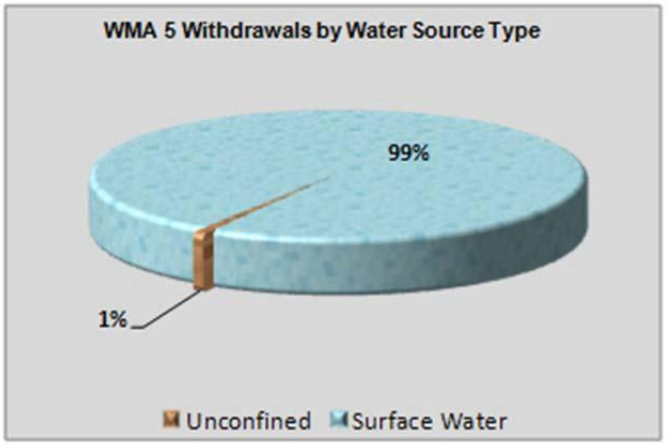
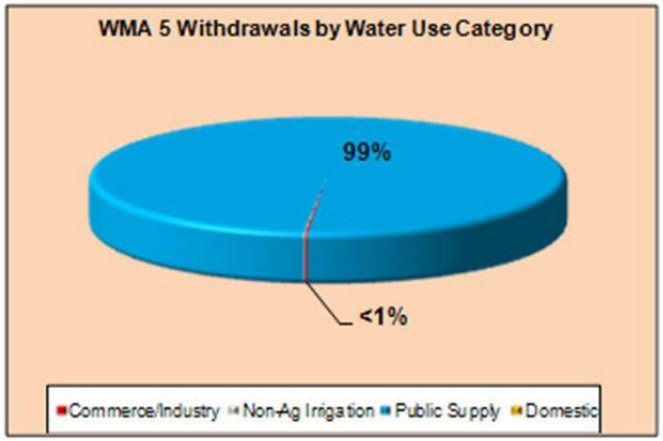


Figure A.5.2



Four water user types are represented within WMA 5 (i.e. public supply, commerce/industry/mining, non-agricultural irrigation, and domestic supply). Withdrawals by water use category in WMA are as follows: public supply – 859.65 MGD (99.7% surface water and 0.3% unconfined groundwater); domestic supply – 0.17 MGD (100% unconfined groundwater); commerce/industry/mining – 1.15 MGD (100% unconfined groundwater); and non-agricultural irrigation – 0.89 MGD (52% unconfined groundwater and 48% surface water). Refer to Figures A.5.1 and A.5.2.

Identification of Public Community Water System's Sources

Table A.5.1 lists the purveyors that serve a population of 1,000 people or more and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 5. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.5.3.

Table A.5.1

Purveyor	Hackensack River (above Hirshfeld Brook)
Park Ridge Water Department	U
United Water NJ	U/S

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Withdrawal Trends of Major Safe Yield Based Water Systems with Surface Water Withdrawals within WMA 5

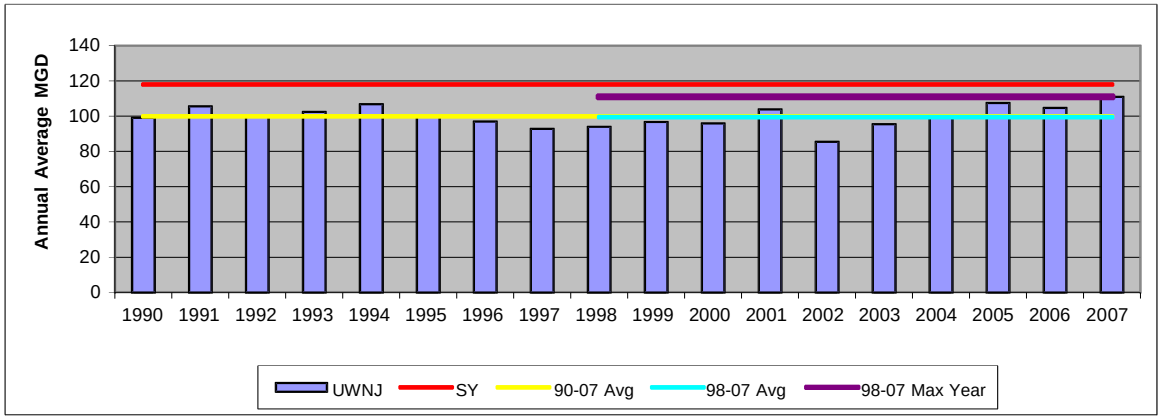
United Water New Jersey (UWNJ) is the largest provider of surface water (safe yield = 118 MGD) for potable supply in WMA 5. UWNJ provides water to the municipalities of Secaucus, Guttenberg, Ridgewood, Wallington, Cliffside Park, Edgewater, Saddle Brook, Wood Ridge, North Bergen, Westwood, Bergenfield, Bogota, Carlstadt, Cliffside, Closter, Cresskill, Demarest, Dumont, East Rutherford, Emerson, Englewood, Englewood Cliffs, Fairview, Fort Lee, Hackensack City, Harrington Park, Hasbrouck Heights, Haworth, Hillsdale, Leonia, Little Ferry, Maywood, Montvale, Moonachie, New Milford, Northvale, Norwood, Oradell, Palisades Park, Paramus, Ridgefield, Ridgefield Park, River Edge, River Vale, Rochelle Park, Rutherford, Teaneck, Tenafly, Teterboro and Washington along with West New York (New Jersey).

United Water New Jersey

PWSID: 0238001

Safe Yield (mgd): 118

90-07 Annual Average Use:	**99.9**	**Unused Safe Yield:**	**18.1**
98-07 Annual Average Use:	**99.5**	**Unused Safe Yield:**	**18.5**
98-07 Maximum Year Use:	**111.0**	**Unused Safe Yield:**	**7.0**



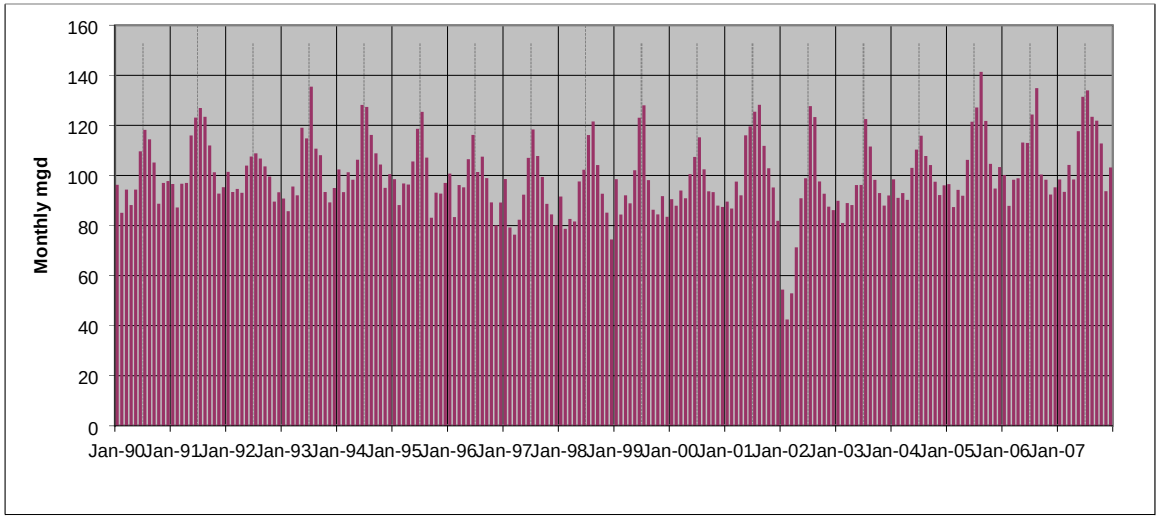
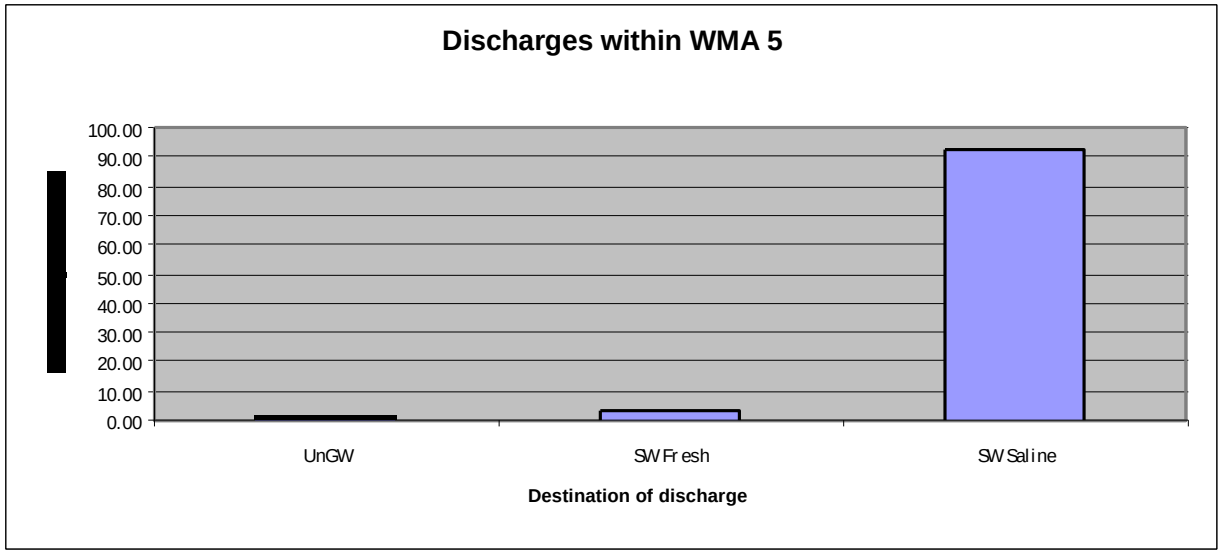


Figure A.5.3 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.*

3) Population and Demand Projections

Table A.5.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 5:

Table A.5.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030101170	Hudson River	269,441	285,845	298,547	307,701	317,688	325,228
02030103170	Hackensack River (above Hirshfeld Brook)	125,176	128,047	128,593	129,462	132,098	134,706
02030103180	Hackensack River (below/including Hirshfeld Brook)	571,519	587,912	602,779	615,029	633,644	654,998
WMA 5 Total Population		**966,136**	**1,001,804**	**1,029,919**	**1,052,192**	**1,083,430**	**1,114,932**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.5.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.5.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030101170	298,547	307,701	0.92	317,688	1.00	325,228	0.75
02030103170	128,593	129,462	0.09	132,098	0.26	134,706	0.26
02030103180	602,779	615,029	1.23	633,644	1.86	654,998	2.14
Totals	**1,029,919**	**1,052,192**	**2.23**	**1,083,430**	**3.12**	**1,114,932**	**3.15**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.5.4 identifies the remaining water available for depletive/consumptive uses (in MGD) for unconfined groundwater/unregulated surface water supplies in each of the three HUC11 watersheds in WMA 5 for each of the three different scenarios, i.e. 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenarios were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive (D/C).

Table A.5.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	1998-2007 D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030101170	Hudson River	1.6	**-21.9**	23.5	**-21.9**	23.5	23.5
02030103170	Hackensack River (above Hirshfeld Brook)	5.0	4.2	0.8	4.7	0.3	0.8
02030103180	Hackensack River (below/including Hirshfeld Brook)	2.5	**-72.8**	75.3	**-72.4**	74.9	75.3

Notes:

1) *The significance of "losses" is explained in more detail under Section 6 below.*
2) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The large volume of water shown to be available for depletive/consumptive purposes in the Hudson River and Hackensack River (below/including Hirshfeld Brook) HUC11 watersheds is misleading because it largely consists of wastewater that is discharged into the saline portions of the Hudson and Hackensack Rivers. Thus, while each of these HUC11 watersheds appears to be gaining water that could be used for depletive/consumptive uses, this should not be interpreted as additional fresh water. Nevertheless, these discharges represent a substantial resource to be utilized as Reclaimed Water for Beneficial Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource (prior to its discharge to saline water) represents an ideal opportunity to meet mitigation objectives where highly consumptive, non-potable water uses currently or are projected to cause stress in one or more HUC11 watersheds.

5) Water Supply Status (Resource Availability)

Table A.5.5 identifies the total resource availability associated with WMA 5. In addition, the table shows the 1998-2007 demands, the full allocation and estimated 2020 demands, and the corresponding remaining available water supply based on these three scenarios.

Table A.5.5 WMA 5 (Hackensack, Hudson and Pascack) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	118	111	6	0
run-of-the-river intakes and unconfined groundwater	9	2	7	5.9
confined groundwater	--	--	--	--
sum:	127	113	13	5.9

WMA 5 2020 Demand and Availability	
current remaining availability	13 mgd
potable use increase by 2020	11.7 mgd
2020 remaining available water	1 mgd

WMA 5 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	93 mgd
potable conservation savings	4.1 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

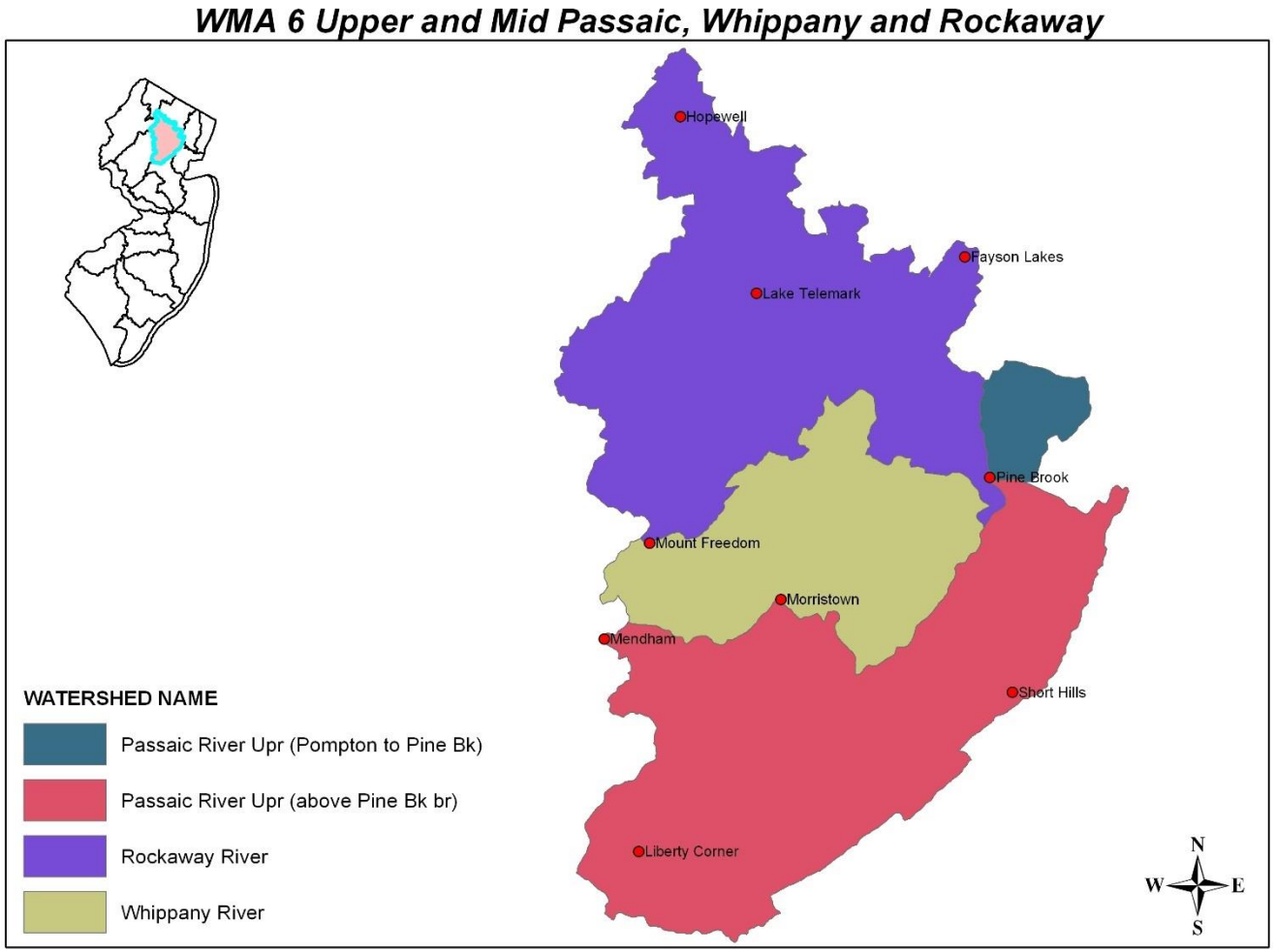
There are no HUC11s in WMA 5 that are currently, or predicted to be stressed.

7) Management Options

UWNJ delivers the vast majority of public supply water to individuals in WMA 5 via surface water supplies and this system has repeatedly experienced new peak summer demands as outdoor irrigation (and therefore consumptive losses) continues to increase. Consumptive water losses in this system tend to have a negative impact on the sustainability of UWNJ's safe yield, thereby causing the decrease in storage of other surface water systems, mainly NJDWSC. While the LFM methodology indicates that the unconfined groundwater resources of the HUC11 watersheds in WMA 5 may be sustainable, the following management options are still warranted to maximize water use efficiency. As such, NJDEP recommends the following items be implemented in WMA 5:

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Consider utilization of available safe yield and/or interconnections to offset existing and potential future depletive/consumptive losses associated with unconfined groundwater uses.
- Continue to coordinate with UWNY regarding the releases of waters from Lake DeForest that should be taking place when the combined levels of the United Water New Jersey's reservoirs (i.e. Oradell Reservoir, Woodcliff Lake and Lake Tappan) are less than 50% of capacity regardless of water being transferred into the Oradell from the Wanaque South project.
- Continue to coordinate with New York Department of Environmental Conservation (NJDEC) and other applicable agencies to address depletive/consumptive activities upstream of this WMA that would affect the sustainability of New Jersey's water resources.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.

Watershed Management Area 6: Upper and Mid Passaic, Whippany and Rockaway



Recommended Initiatives for Watershed Management Area 6: Upper and Mid Passaic, Whippany and Rockaway

1) Description of Planning Area

Watershed Management Area 6 represents the area drained by waters from the upper reaches of the Passaic River Basin (from the Passaic River headwaters in Morris County to its confluence with the Pompton River in Passaic County), and includes the following four HUC11 watersheds – Upper and Middle Passaic River, Whippany River and Rockaway River. Portions of Morris, Somerset, Sussex and Essex Counties lie within WMA 6, and, despite substantial surface water withdrawals here (which water is exported predominantly to WMAs 4 and 7), the area is largely reliant on groundwater sources for water supply.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 6 are derived from unconfined groundwater and surface water sources. Within WMA 6, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 774.15 MGD, of which 10% was diverted from unconfined groundwater and 90% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater = 75.77 MGD
Surface Water = 4.31 MGD
Regulated Surface Water = 664 MGD[6]

[6] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined ground-water withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.6.1

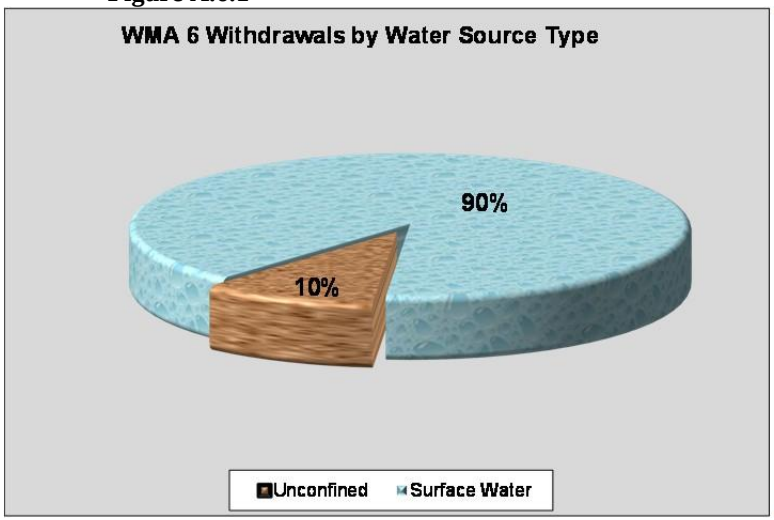
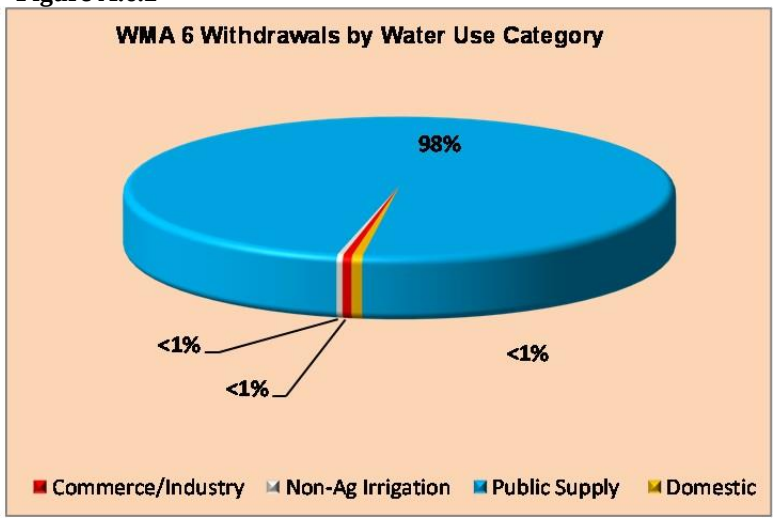


Figure A.6.2



The majority of the surface water diverted in WMA 6 is associated with regulated surface water withdrawals. United Water Jersey City (UWJC) has the largest regulated surface water diversion in WMA 6. UWJC operates the Boonton and Splitrock Reservoirs in the Rockaway River HUC11 in which water is provided to the cities of Jersey City, Caldwell and Lyndhurst.

There are four water user categories represented within WMA 6 (i.e. public supply, commerce/industry/mining, non-agricultural irrigation, and domestic supply). Withdrawals by water use category in WMA 6 are as follows: public supply — 732.99 MGD (91% unconfined groundwater and 5% surface water); domestic supply – 4.65 MGD (100% unconfined groundwater); commerce/industry/mining – 3.87 MGD (94% unconfined groundwater 6% surface water); non-agricultural irrigation – 2.64 MGD (79% unconfined groundwater and 21% surface water). Refer to Figures A.6.1 and A.6.2.

Identification of Public Community Water System's Sources

Table A.6.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 6. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.6.3.

Table A.6.1

Purveyor	Passaic River Upper (above Pine Brook)	Whippany River	Rockaway River	Passaic River Upper (Pompton to Pine Brook)
Boonton Water Department			U/S	
Chatham Water Department	U			
Denville Township Water Department		U	U	
Dover Water Commission			U	
East Hanover Twp. Water District		U		
East Orange Water Commission	U			
Essex Fells Water Department	U			
Fairfield Water Department				U
Fairleigh - Dickinson University		U		
Fayson Lakes Water Company Inc.			U	
Florham Park Water Department	U	U		
Jefferson Twp. Water Utility - Lake Hopatcong			U	
Jefferson Twp. Water Utility Milton System			U	
Jersey City MUA			S	
Livingston Twp. Division of Water	U			
Madison Water Department	U	U		
Morris County MUA		U		
Mountain Lakes Water Department		U	U	
NJ American Water Company	U/S	U		
Parsippany-Troy Hills Water Department		U	U	
Picatinny Arsenal			S/U	
Rockaway Borough Water Department			U	
Rockaway Twp. Water Department			U	
Sisters of Charity of SE		U		
Southeast Morris County MUA	U	U/S		
Sparta Twp. Water Utility - Highlands			U	
Sparta Twp. Water Utility – Lake Mohawk			U	
West Caldwell Water Department	U			
Wharton Water Department			U	

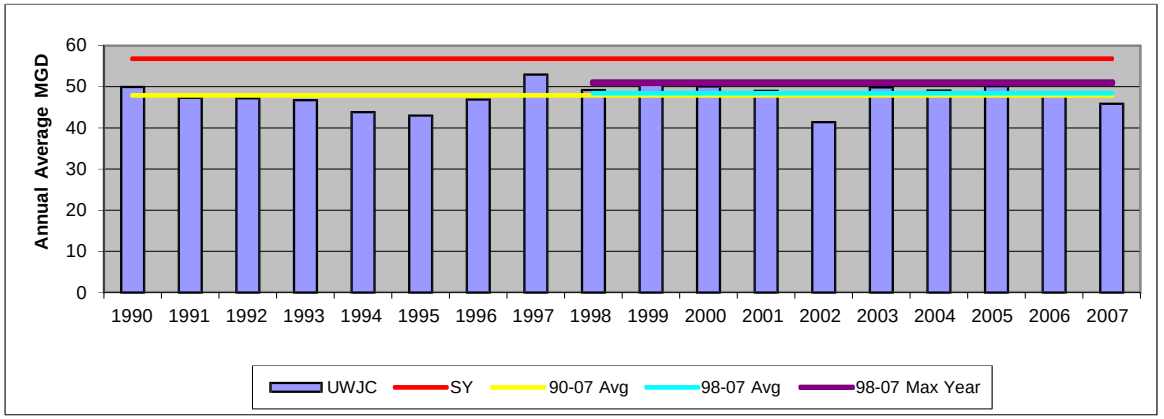
For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

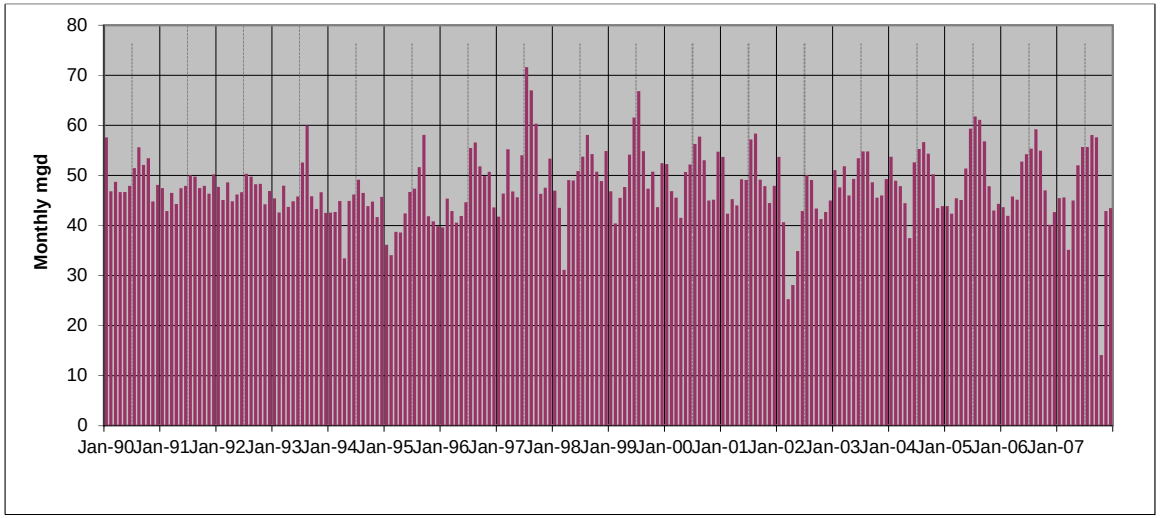
United Water Jersey City

PWSID: 0906001

Safe Yield (mgd): 56.8

90-07 Annual Average Use: 47.9	**Unused Safe Yield: 8.9**
98-07 Annual Average Use: 48.4	**Unused Safe Yield: 8.4**
98-07 Maximum Year Use: 51.0	**Unused Safe Yield: 5.8**



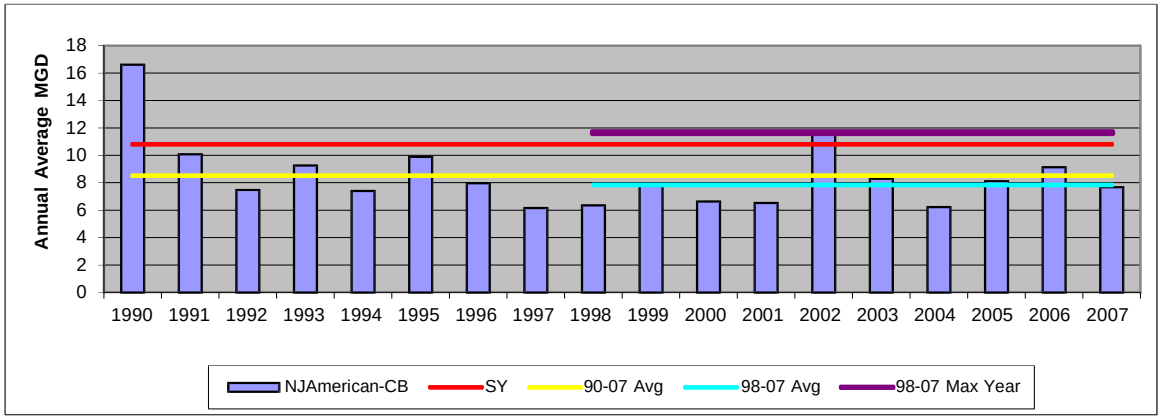


New Jersey American – Canoe Brook

PWSID: 0712001

Safe Yield (mgd): 10.8

90-07 Annual Average Use: 8.5	**Unused Safe Yield: 2.3**
98-07 Annual Average Use: 7.8	**Unused Safe Yield: 3.0**
98-07 Maximum Year Use: 11.7	**Unused Safe Yield: -0.9**



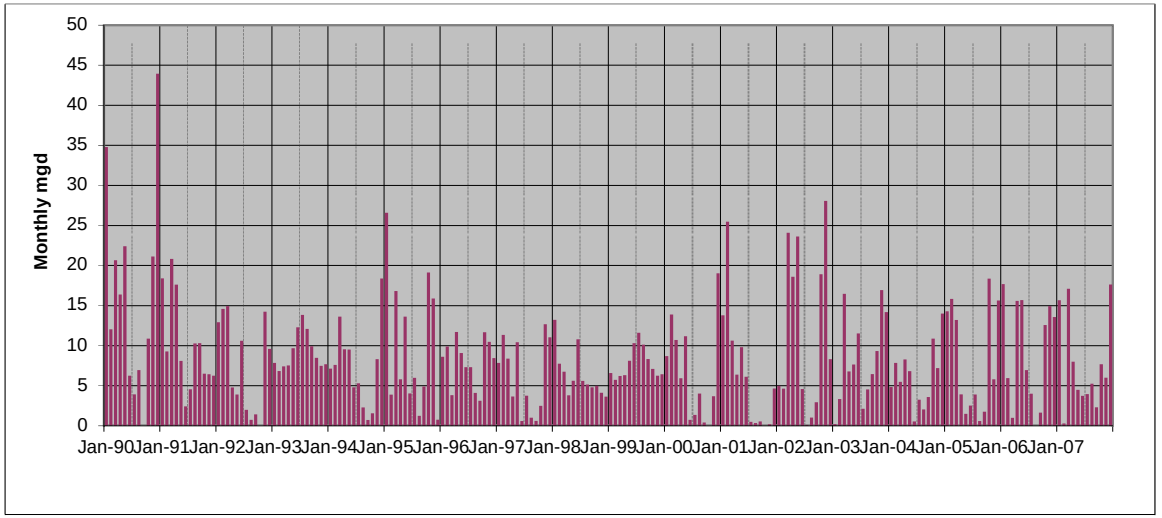
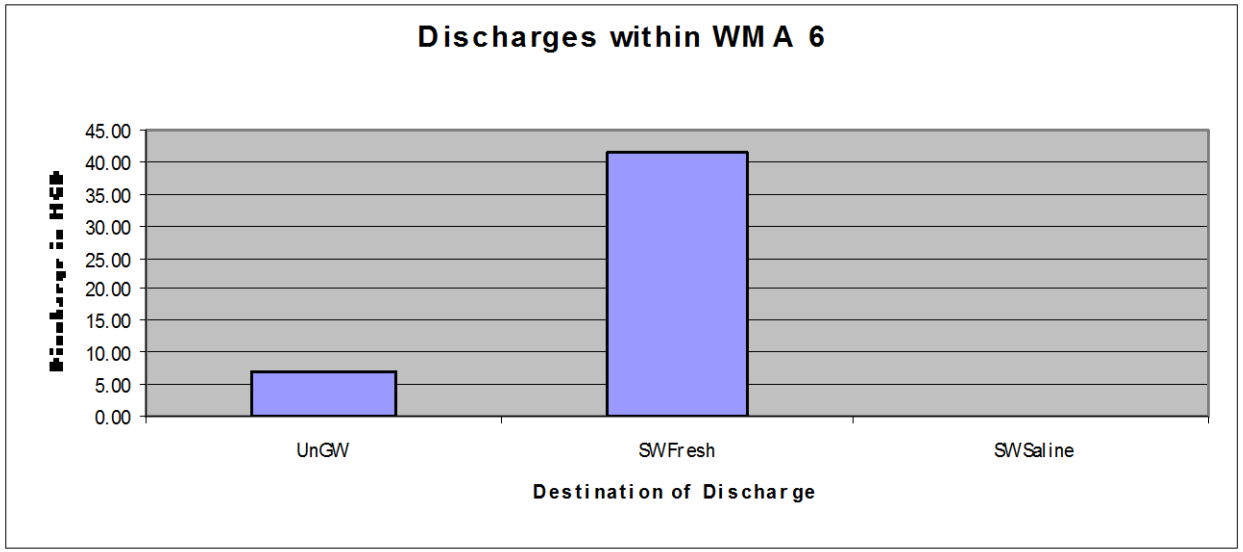


Figure A.6.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.6.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 6:

Table A.6.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030103010	Passaic River Upper (above Pine Brook)	198,797	204,880	207,917	210,609	213,805	218,316
02030103020	Whippany River	111,304	115,678	117,407	118,035	117,477	117,604
02030103030	Rockaway River	139,308	143,565	145,462	147,666	148,470	150,065
02030103040	Passaic River Upper (Pompton to Pine Brook)	11,186	11,292	11,339	11,396	11,464	11,601
WMA 6 Total Population		**460,595**	**475,415**	**482,125**	**487,706**	**491,216**	**497,586**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.6.3* shows the additional demand that is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.6.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030103010	207,917	210,609	0.27	213,805	0.32	218,316	0.45
02030103020	117,407	118,035	0.06	117,477	-0.06	117,604	0.01
02030103030	145,462	147,666	0.22	148,470	0.08	150,065	0.16
02030103040	11,339	11,396	0.01	11,464	0.01	11,601	0.01
Totals	**482,125**	**487,706**	**0.56**	**491,216**	**0.35**	**497,586**	**0.63**

4) Available Water for Depletive/Consumptive Uses – Unconfined Aquifers/Unregulated Surface Water

Table A.6.4 identifies the remaining water available for depletive/consumptive uses (in MGD) for unconfined groundwater/unregulated surface water supplies in each of the four HUC11 in WMA 6 for each of the three different scenarios, i.e. 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenarios were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive. Please be advised for the purpose of this summary, water availability values for all four scenarios have been "grayed" out in the HUC11 watersheds that are wholly located in the Highlands as the Highlands Regional Master Plan (HRMP) presents availability values for these areas by HUC14 sub-watershed.

Table A.6.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Use in 2020 (MGD)
02030103010	Passaic River Upper (above Pine Brook)	5.7	13.0	-7.3	37.1	-31.5	-8.2
02030103020	Whippany River	3.1	15.1	-12.1	17.0	-13.9	-12.2
02030103030	Rockaway River						
02030103040	Passaic River Upper (Pompton to Pine Brook)	0.5	0.2	0.3	0.5	0.1	0.1
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

1) *New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.*
2) *The significance of "losses" is explained in more detail under Section 6 below.*

5) Water Supply Status (Resource Availability)

Table A.6.5 identifies the total resource availability associated with WMA 6. In addition, the table shows the 1998-2007 demands, the full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 6 for each of these three scenarios.

Table A.6.5 WMA 5 (Upper and Mid Passaic, Whippany and Rockaway) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	72	65	7	0
run-of-the-river intakes and unconfined groundwater	15	24	-9	-40
confined groundwater	--	--	--	--
sum:	87	89	-2	-40

WMA 6 2020 Demand and Availability	
remaining availability	-2 mgd
potable use increase by 2020	3.1 mgd
2020 remaining available water	-5 mgd

WMA 6 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	2.5 mgd
unbuilt water supply projects	30 mgd

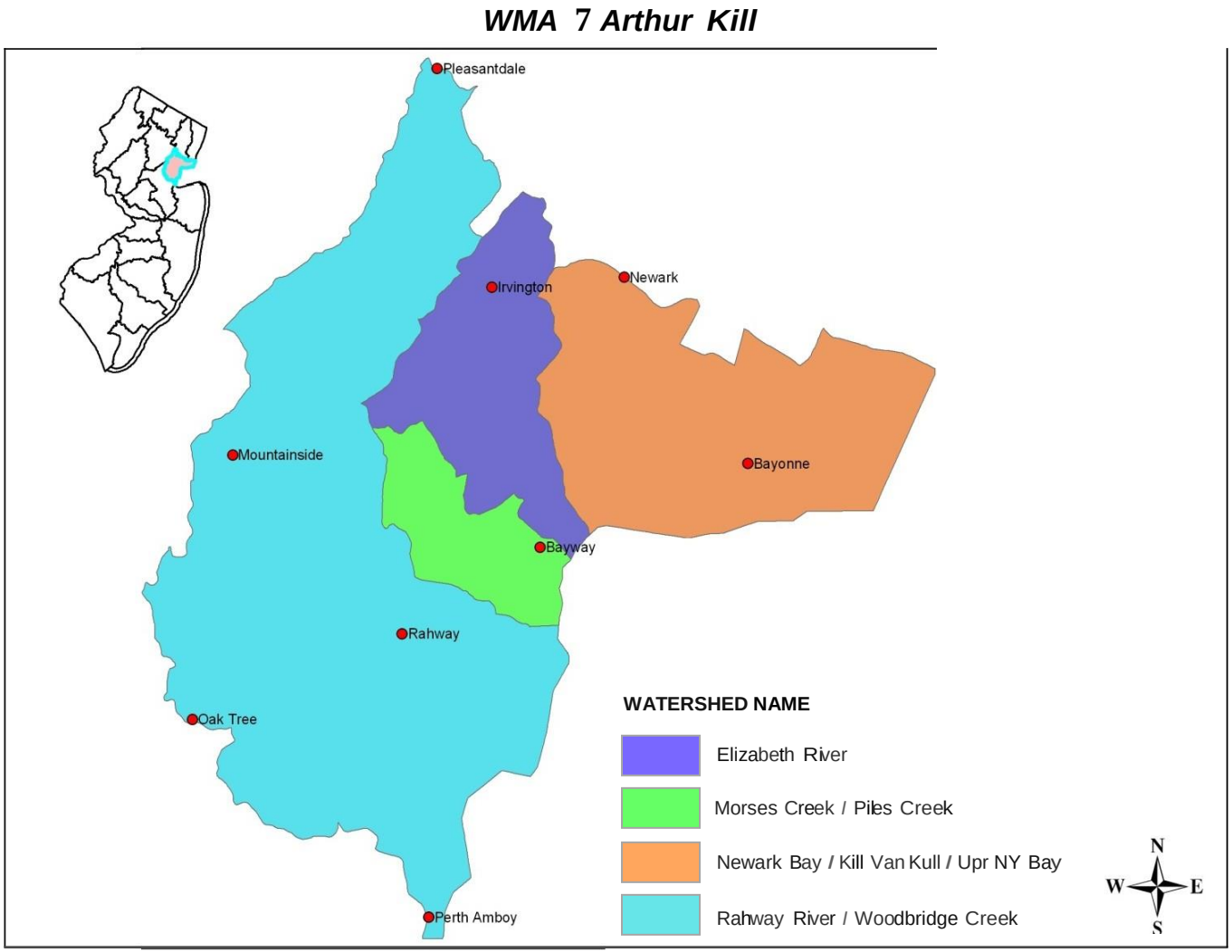
6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

The primary reason for the identified stress condition in the Upper Passaic River (above Pine Brook) HUC11 watershed is the export of a majority of wastewater generated to another watershed. As for the Whippany River HUC11 watershed (which shows a negative water availability value, there is disagreement surrounding the specific discharge location of the Parsippany-Troy Hills Sewerage Treatment Plant (NJ0024970). The existing NJPDES permit indicates that the discharge is to the lower portion of the Whippany River HUC11 just before its confluence with the Rockaway River; however, the GIS data used in support of this Plan indicates the discharge location is to the Rockaway River just above the confluence with the Whippany. This discrepancy results in a perceived deficit for the Whippany River HUC11 since generated wastewater is shown to be exported. If the actual location of the discharge is demonstrated to be to the Whippany River, there would be neither an export nor an indicated deficit for this watershed. The NJDEP expects to address this issue through the NJPDES permit renewal process.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Allow no additional D/C uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Upper Passaic River (above Pine Brook) HUC11 will be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of an existing depletive/consumptive use, increased storage; or increased recharge.
- Complete "Development of Reconstructed Streamflows in the Passaic and Hackensack River Basins, Water Years 1922-2007" in coordination with stakeholders.
- Consider utilizing available safe yield and/or interconnections to offset existing and potential future depletive/consumptive losses associated with unconfined groundwater uses.

Watershed Management Area 7: Arthur Kill



Recommended Initiatives for Watershed Management Area 7: Arthur Kill

1) Description of Planning Area

Watershed Management Area (WMA) 7 lies in portions of Middlesex, Union and Essex Counties and has a drainage area of 197.4 square miles. Land uses found in the Rahway and Elizabeth HUC11 watersheds are primarily residential, commercial and industrial. The main stem of the Rahway River flows from Union County into the Arthur Kill near Linden and is tidal from the Pennsylvania Railroad Bridge in Rahway to the mouth of the Newark Bay. Major tributaries include the East Branch Rahway River, Woodbridge River and Robinson's Branch. The following surface water impoundments are located within WMA 7: Middlesex Reservoir; Orange Reservoir; Lower and Upper Echo Lakes; and Diamond Mill Pond.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 7 are derived from unconfined groundwater and surface water sources. Within WMA 7, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 28.48 MGD, of which 64% was diverted from unconfined groundwater and 36% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater = 18.35 MGD
Surface Water = 10.14 MGD
Confined groundwater = 0 MGD

Figure A.7.1

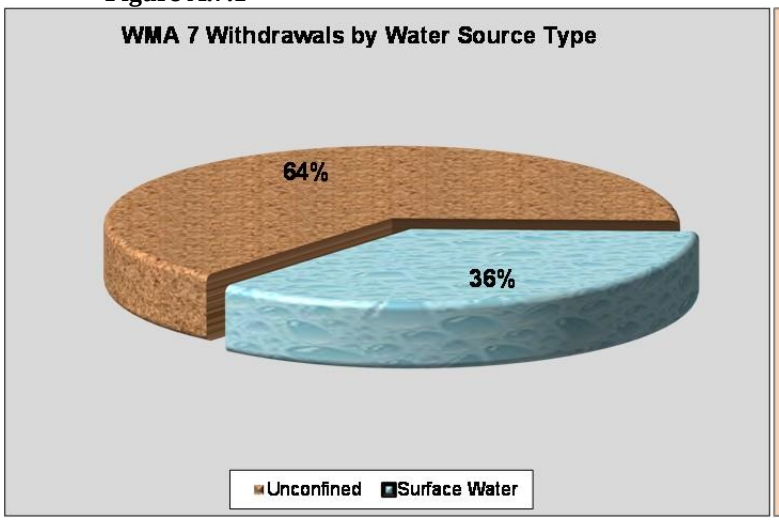
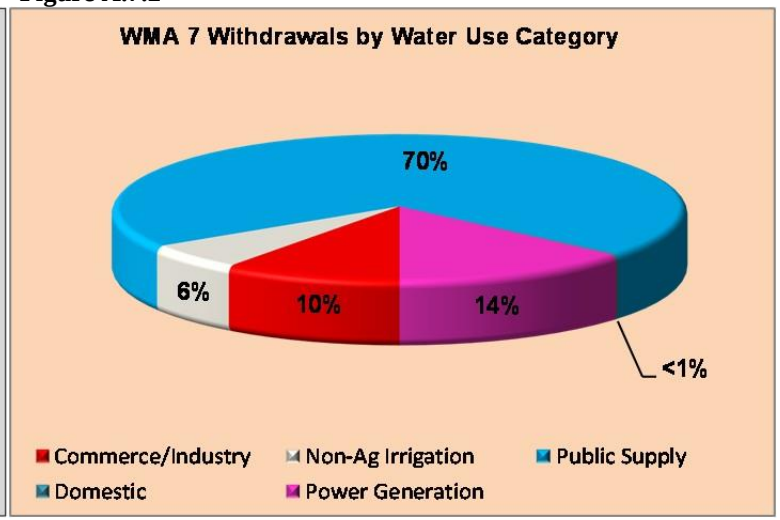


Figure A.7.2



There are five water user categories represented within WMA 7 (public supply, commerce/industry/mining, non-agricultural irrigation, domestic supply and power generation). Withdrawals by water use category in WMA 7 are as follows: public supply – 20.02 MGD (71% unconfined groundwater and 29% surface water); domestic supply – 0.08 MGD (100% unconfined groundwater); commerce/industry/mining – 2.87 MGD (100% groundwater); non-agricultural irrigation – 1.66 MGD (71% groundwater and 29% surface water) and power generation – 3.85 MGD (100% surface water). Refer to Figures A.7.1 and A.7.2.

Identification of Public Community Water System's Sources

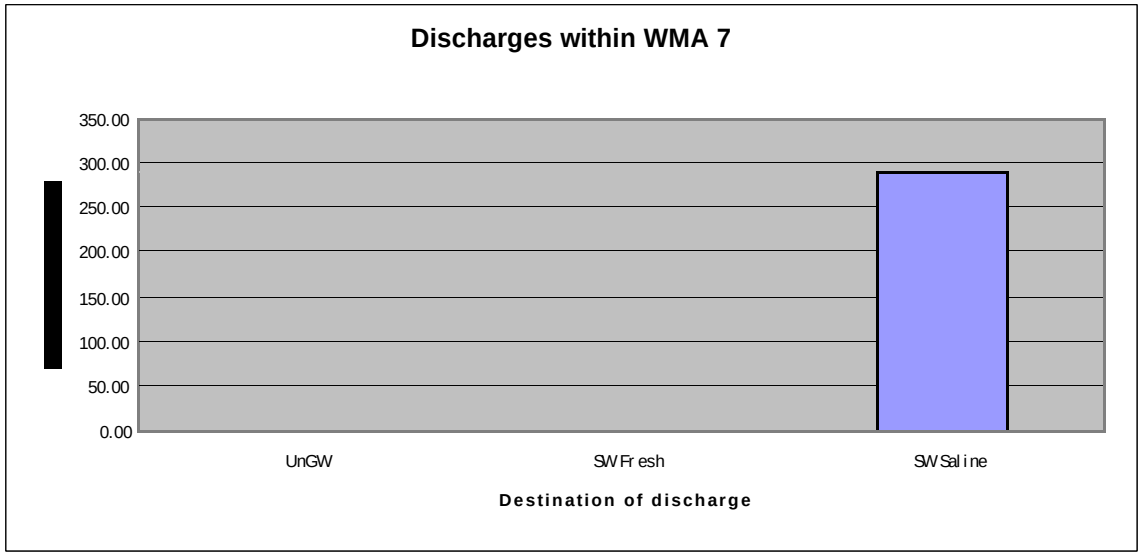
Table A.7.1 lists the purveyors who serve a population of 1,000 or more people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 7. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.7.3.

Table A.7.1

Purveyor	Elizabeth	Morses Creek /	Rahway River / Woodbridge Creek
Middlesex Water Company			U/S
New Jersey American Water Company -	U	U	U
New Jersey American Water Company			U
Orange Water Department			U/S
South Orange Water Department			U
United Water - Rahway			U/S

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.7.3 1998 to 2007 Average NJPDES Discharges by Source



Note: Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.

3) Population and Demand Projections

Table A.7.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 7:

Table A.7.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030104010	Newark Bay / Kill Van Kull / Upper NY Bay	360,113	370,720	383,044	395,359	412,390	426,382
02030104020	Elizabeth River	234,178	239,704	243,779	248,123	256,469	265,026
02030104030	Morses Creek / Piles Creek	63,856	64,822	65,764	67,333	70,055	72,784
02030104050	Rahway River / Woodbridge Creek	421,589	429,082	438,939	450,405	466,342	479,955
WMA 7 Total Population		**1,079,736**	**1,104,328**	**1,131,526**	**1,161,220**	**1,205,256**	**1,244,147**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.7.3* shows the additional demand is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.7.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030104010	383,044	395,359	1.23	412,390	1.70	426,382	1.40
02030104020	243,779	248,123	0.43	256,469	0.83	265,026	0.86
02030104030	65,764	67,333	0.16	70,055	0.27	72,784	0.27
02030104050	438,939	450,405	1.15	466,342	1.59	479,955	1.36
Totals	**1,131,526**	**1,161,220**	**2.97**	**1,205,256**	**4.39**	**1,244,147**	**3.89**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.7.4 identifies the remaining water available for depletive/consumptive uses (MGD) for **unconfined groundwater/ unregulated surface water supplies** in each of WMA 7's four HUC11 watersheds based on three different scenarios -- 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-200 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive (D/C).

Table A.7.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030104010	Newark Bay / Kill Van Kull / Upper NY Bay	2.2	-209.2	211.4	-209.1	211.3	211.4
02030104020	Elizabeth River	2.2	-48.6	50.7	-45.2	47.4	50.7
02030104030	Morses Creek / Piles Creek	0.3	0.4	**-0.1**	0.7	**-0.4**	**-0.1**
02030104050	Rahway River / Woodbridge Creek	2.3	-14.1	16.4	-3.2	5.6	16.1

Notes:

5) The significance of "losses" is explained in more detail under Section 6 below.

6) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The large volumes of water shown to be available for depletive/consumptive purposes in the Newark Bay/Kill Van Kull/Upper New York Bay, Elizabeth River and Rahway River/Woodbridge Creek HUC11 watersheds are misleading because they largely consist of wastewater that is discharged into saline waters in the tidal portions of the HUC11 watersheds. Thus, while each of these HUC11 watersheds appears to be gaining water that could be used for depletive/consumptive uses, this should not be interpreted as additional available fresh water. Nevertheless, these discharges represent a potential resource to be utilized as Reclaimed Water for Beneficial Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource (prior to its discharge to tidal water) represents an ideal opportunity to meet mitigation objectives where highly consumptive, non-potable water uses currently or are projected to cause stress in one or more HUC11 watersheds.

5) Water Supply Status (Resource Availability)

Table A.7.5 identifies the total resource availability associated with WMA 7. In addition, the table shows 1998-2007 uses, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 7 based on each of these three scenarios.

Table A.7.5 WMA 5 (Arthur Kill) Available Water and Demand, by source

Source of Water	**Demand & Availability (mgd)**			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	7	20	-13	-28
confined groundwater	--	--	--	--
sum:	7	20	-13	-28

WMA 7 2020 Demand and Availability	
remaining availability	-13 mgd
potable use increase by 2020	12.6 mgd
2020 remaining available water	-25 mgd

WMA 7 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	291 mgd
potable conservation savings	202 mgd
unbuilt water supply projects	30 mgd

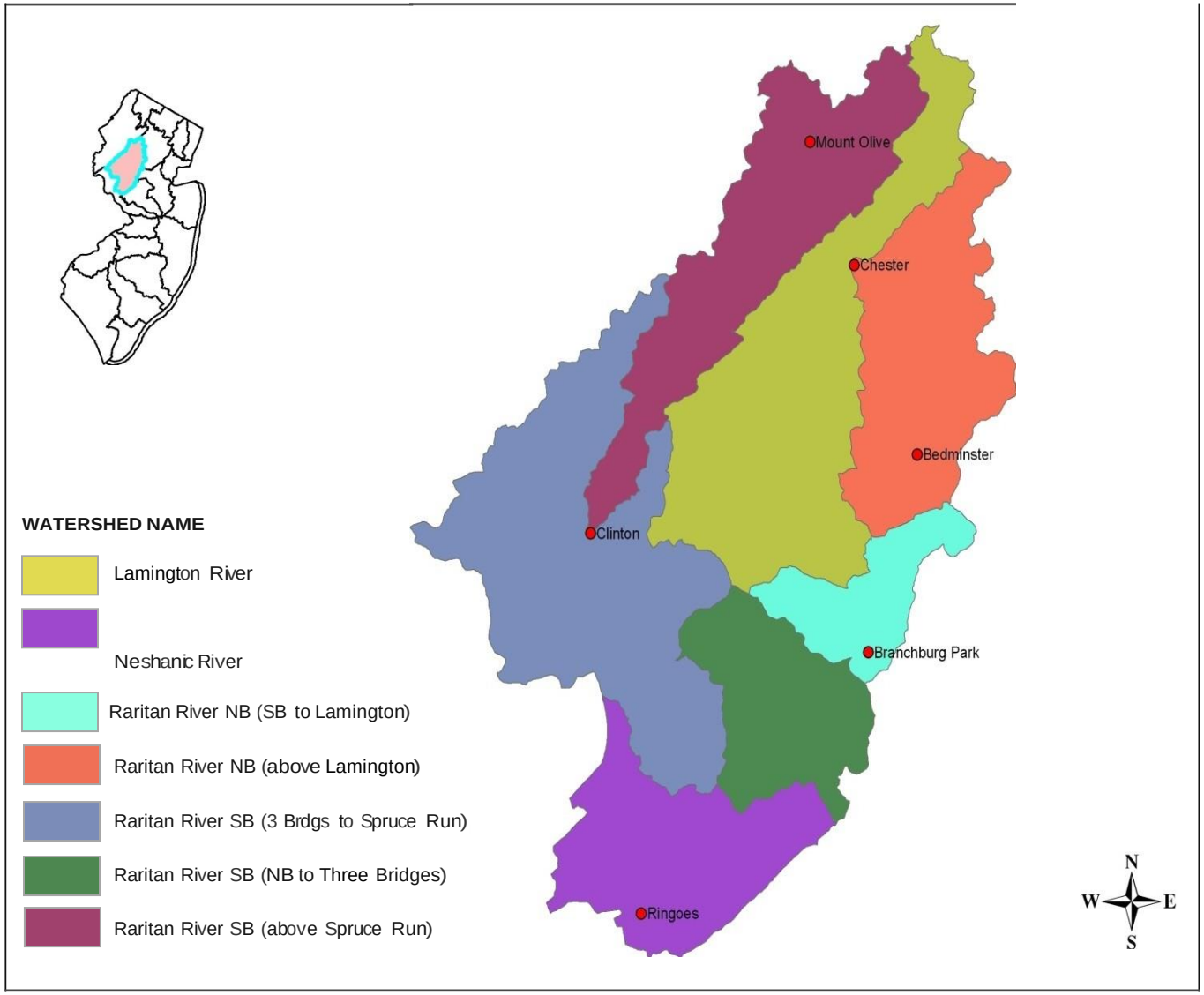
6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

The primary reason for the identified stress condition in the Morses Creek/Piles Creek HUC11 watershed is the export of generated wastewater to another HUC11 watershed. This export, in combination with the watershed's very low 7Q10 value and corresponding LFM, creates the stress condition.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- DEP will continue to monitor the Morses Creek/Piles Creek HUC11 watershed as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
  - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.

Watershed Management Area 8 North and South Branch Raritan



Recommended Initiatives for Watershed Management Area 8 North and South Branch Raritan

1) Description of Planning Area

Watershed Management Area 8 (WMA 8) is located in the Highlands and Piedmont Physiographic Provinces. There are seven HUC11 watersheds in WMA 8 including: South Branch Raritan River (above Spruce Run), South Branch Raritan River (Three Bridges to Spruce Run), South Branch Raritan River (North Branch to Three Bridges), North Branch Raritan River (above Lamington), North Branch Raritan River (South Branch to Lamington), Lamington River and Neshanic River. WMA 8 lies in portions of Somerset, Hunterdon and Morris Counties.

Major tributaries to the North Branch Raritan River include Peapack Brook, Rockaway Creek and Lamington River. The North Branch of the Raritan River is 23 miles long and flows from northwestern Morris County through Somerset County to its confluence with the South Branch Raritan River between the towns of Branchburg and Raritan. The watershed land use characteristics include a mixture of rural, woodland and agriculture interspersed with areas of commercial and residential development (some of which is intensive along the major roadway corridors).

Major tributaries to the South Branch Raritan River include the Neshanic River, Spruce Run Creek, Mulhockaway Creek and Cakepoulin Creek. Major surface water impoundments are the Spruce Run and Round Valley Reservoirs. For additional information pertaining to these reservoirs, please refer to Chapter 3. The South Branch of the Raritan River is 51 miles long and flows from western Morris County through central Hunterdon County into western Somerset County before joining the North Branch and forming the main stem of the Raritan River. Agriculture remains the predominant land use type in the South Branch Raritan River Watershed, although suburban-commercial development is increasing at a rapid rate.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 8 are derived from unconfined groundwater and surface water sources. Within WMA 8, the peak annual withdrawal (unconfined groundwater and surface water) during 1998-2007 amounted to 33.05 MGD, of which 94% was diverted from unconfined groundwater and 6% from surface water. The daily water use volume breakdown is as follows:

Unconfined groundwater = 30.99 MGD
Surface Water = 2.06 MGD
Confined groundwater = 0 MGD

Figure A.8.1

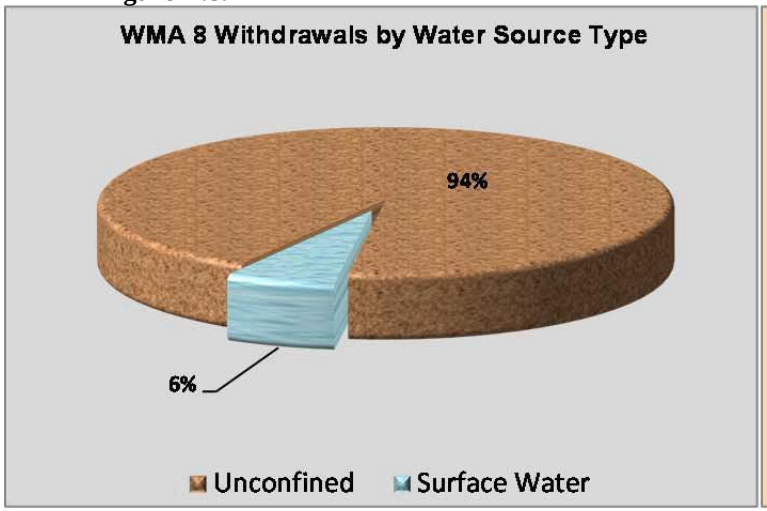
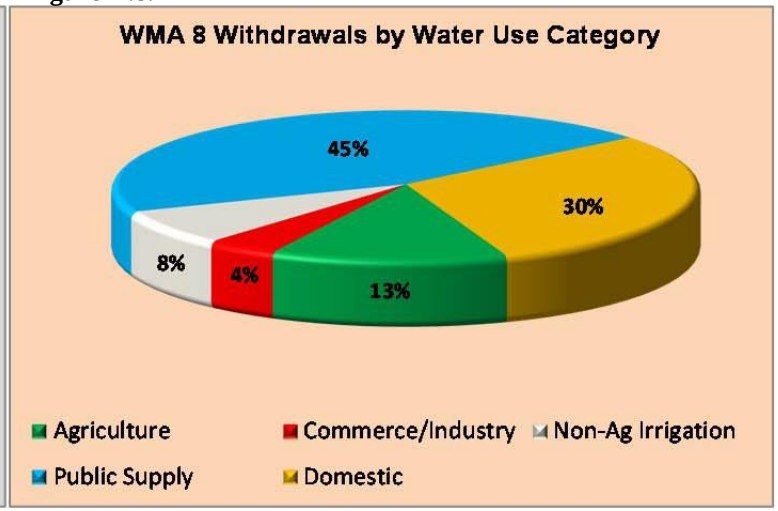


Figure A.8.2



There are five water user categories represented within WMA 8 (public supply, agriculture, commerce/industry/mining, non- agricultural irrigation, and domestic supply). Withdrawals by water user category in WMA 8 are as follows: public supply – 14.91 MGD (98% unconfined groundwater and 2% surface water); domestic supply – 10 MGD (100% unconfined groundwater); agriculture – 4.30 MGD (97% groundwater and 3% surface water); commerce/industry/mining – 1.32 MGD (52% groundwater 48% surface water); and non-agricultural irrigation – 2.51 MGD (60% groundwater and 40% surface water). Refer to Figures A.8.1 and A.8.2.

Identification of Public Community Water System's Sources

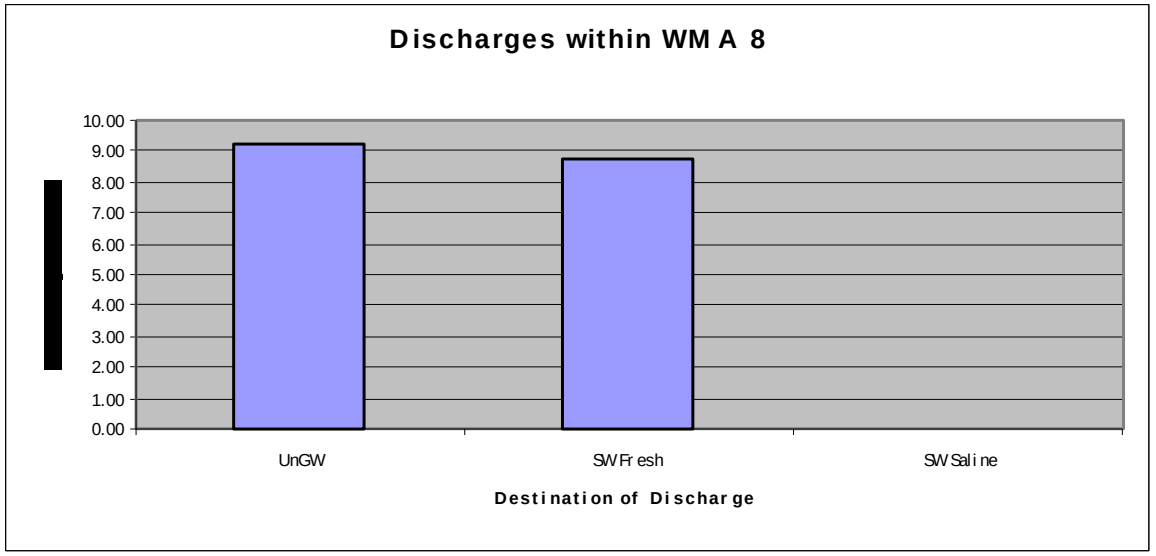
Table A.8.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 8. Diversion types are noted as follows: Unconfined groundwater (U); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.8.3.

Table A.8.1

Purveyor	Raritan River SB (above Spruce Run)	Raritan River SB (3 Bridges to Spruce Run)	Neshanic River	Lamington River	Raritan River NB (above Lamington)	Raritan River NB (SB to Lamington)
Aqua NJ Inc. Califon	U					
Clinton Water Department		U		U		
Edna Mahan Correctional		U				
Flemington Water Department		U	U			
Glen Gardner Water Department		U				
High Bridge Water Department	U	U				
Morris County MUA	U			U		
Mount Olive Twp. Water Department Main	U					
Mount Olive Villages Water	U					
New Jersey American Water Company - Elizabethtown		U		U		U
New Jersey American Water Company					U	
Roxbury Twp. Water Department - Skyview	U					
Roxbury Water Company	U			U		
United Water - Arlington Hills				U		
Washington Twp. MUA - Hager	U			U		
Washington Twp. MUA School	U					

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.8.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.8.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 8:

Table A.8.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030105010	Raritan River SB (above Spruce Run)	42,330	43,766	44,335	44,620	44,338	44,520
02030105020	Raritan River SB (3 Bridges to Spruce Run)	39,396	42,373	43,262	43,649	44,411	45,616
02030105030	Neshanic River	19,888	21,858	22,326	22,923	23,460	24,208
02030105040	Raritan River SB (NB to Three Bridges)	20,944	21,618	22,346	23,069	24,155	25,128
02030105050	Lamington River	39,105	40,832	41,559	42,263	42,460	43,211
02030105060	Raritan River NB (above Lamington)	29,091	29,920	30,635	31,312	31,446	31,802
02030105070	Raritan River NB (SB to Lamington)	19,720	20,404	20,803	21,167	21,597	22,056
WMA 8 Total Population		**210,474**	**220,771**	**225,266**	**229,003**	**231,867**	**236,541**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.8.3* shows the additional demand is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.8.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030105010	44,335	44,620	0.03	44,338	-0.03	44,520	0.02
02030105020	43,262	43,649	0.04	44,411	0.08	45,616	0.12
02030105030	22,326	22,923	0.06	23,460	0.06	24,208	0.07
02030105040	22,346	23,069	0.07	24,155	0.11	25,128	0.10
02030105050	41,559	42,263	0.07	42,460	0.02	43,211	0.08
02030105060	30,635	31,312	0.07	31,446	0.01	31,802	0.04
02030105070	20,803	21,167	0.04	21,597	0.04	22,056	0.05
Totals	**225,266**	**229,003**	**0.38**	**231,867**	**0.29**	**236,541**	**0.48**

4) Available Water for Depletive/Consumptive Uses – Unconfined Ground Water/Unregulated Surface Water

*Table A.8.*5 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the seven HUC11 watersheds within WMA 8 under three different scenarios -- 1998-2007 demands, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive (D/C) uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive. Please be advised for the purpose of this summary, water availability values have been "grayed" out in the HUC11 watersheds that are located entirely within the Highlands as the Department is deferring to the HRMP, which provides this information by HUC14 watershed.

Table A.8.5

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030105010	Raritan River SB (above Spruce Run)						
02030105020	Raritan River SB (3 Bridges to Spruce Run)	4.5	-0.6	5.1	2.6	2.0	5.1
02030105030	Neshanic River	0.8	1.6	**-0.8**	2.3	**-1.5**	**-0.8**
02030105040	Raritan River SB (NB to Three Bridges)	1.5	1.5	0.1	1.4	0.1	0.1
02030105050	Lamington River	5.8	4.2	1.6	9.4	**-3.6**	1.6
02030105060	Raritan River NB (above Lamington)						
02030105070	Raritan River NB (SB to Lamington)	0.4	0.4	0.0	0.6	**-0.1**	**-0.1**
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

7) New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.

8) The significance of "losses" is explained in more detail under Section 6 below.

9) *A negative value in a loss column (SHADED BLUE) indicates a gain to the HUC11 watershed.*

5) Water Supply Status (Resource Availability)

Table A.8.4 identifies the total resource availability associated with WMA 8. In addition, the table shows 1998-2007 demands, full allocation and estimated 2020 demands, and the corresponding remaining available water supply in WMA 8 under each of these three scenarios.

Table A.8.5 WMA 5 (North and South Branch Raritan) Available Water and Demand, by source

Source of Water	**Demand & Availability (mgd)**			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	21	12	9	-5.9
confined groundwater	--	--	--	--
sum:	21	12	9	-5.9

WMA 8 2020 Demand and Availability	
remaining availability	9 mgd
potable use increase by 2020	2.1 mgd
2020 remaining available water	7 mgd

WMA 8 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	3.4 mgd
unbuilt water supply projects	40 mgd

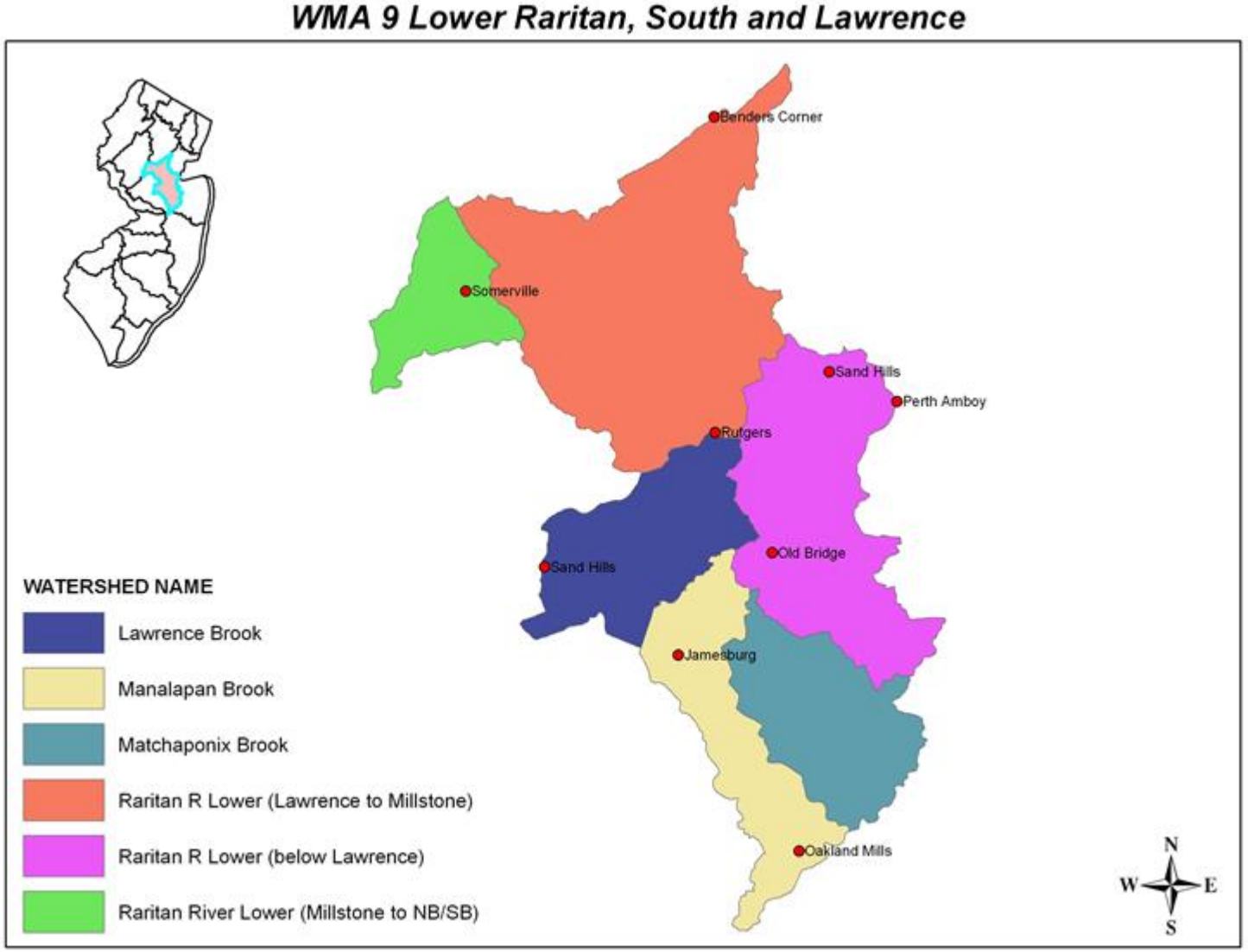
6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

Under the full allocation scenario, the Neshanic, Lamington and the North Branch Raritan (South Branch to Lamington) Rivers HUC11 watersheds are shown to be stressed. In general, there is very little available unconfined groundwater in the Neshanic and North Branch Raritan (South Branch to Lamington) River HUC11 watersheds due to the quantified low September median and 7Q10 flows in these two HUC11 watersheds. As for the Lamington River HUC11 watershed, the data indicates that the reason for the full allocation stress indicator is the exportation of public water supply from this HUC11 watershed.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Neshanic River HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Lamington River and the North Branch Raritan River (South Branch to Lamington) HUC11s as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield or entering a contract with the New Jersey Water Supply Authority.
- Utilize available safe yield and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined groundwater uses.
- Retain properties associated with the Six Mile Run and the Confluence Pump Station and reevaluate the feasibility of developing these properties as a future capital water supply projects (Policy Item # 4).
- For HUC11 watersheds that are located wholly within the New Jersey Highlands, please refer to the Highlands Regional Master Plan at http://www.nj.gov/njhighlands/master/

Watershed Management Area 9 Lower Raritan, South River and Lawrence



Recommended Initiatives for Watershed Management Area 9 Lower Raritan, South River and Lawrence

1) Description of Planning Area

Watershed Management Area (WMA) 9 is located in the state's Piedmont and Coastal Plain physiographic provinces. Six individual HUC11 watersheds comprise WMA 9, as depicted above. Major water bodies include the main stem of the Raritan River, the South River and Lawrence Brook within Middlesex, Somerset and Monmouth Counties.

The main stem of the Raritan River extends generally eastward from the confluence of the North and South Branches of the Raritan to the Raritan Bay. For the most part, this drainage area is a densely populated mixed urban/suburban landscape characterized primarily by residential and commercial/industrial water usage. Among the many small recreational lakes and ponds in this area are Watchung Lake, Surprise Lake, Spring Lake and Green Brook Pond (all manmade).

The South River begins at Duhernal Lake in Spotswood and flows to the Raritan River at Sayreville. It is formed by the confluence of the Manalapan and Matchaponix Brooks along with tributaries that include Deep River and Tennants Brook. Land use in the upper part of the Manalapan and Matchaponix Brooks HUC11 watersheds is predominantly agricultural and forested, while in the South River HUC11 commercial/industrial and residential development is progressively being introduced amid existing, established development centers.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 9 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 9, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 1,493.98 MGD, of which 3% was diverted from unconfined groundwater, 96% from surface water and 1% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 49.98 MGD
Surface Water = 10.58 MGD
Regulated Surface Water = 1,411.99 MGD[7]
Confined groundwater = 21.43 MGD

Figure A.9.1

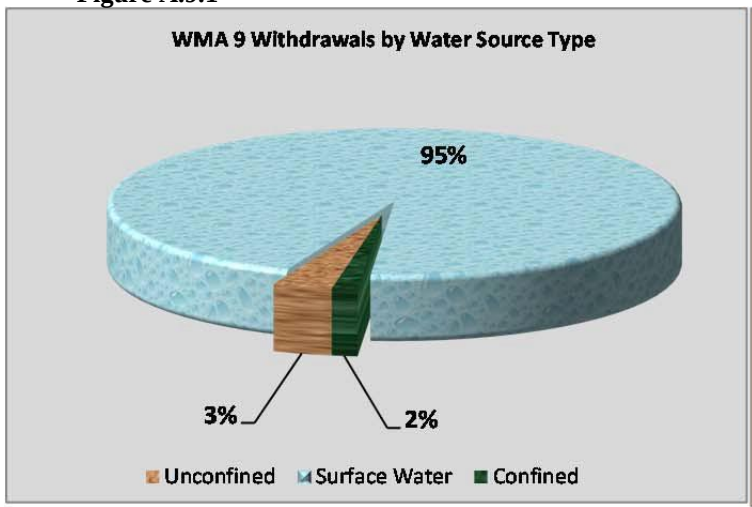
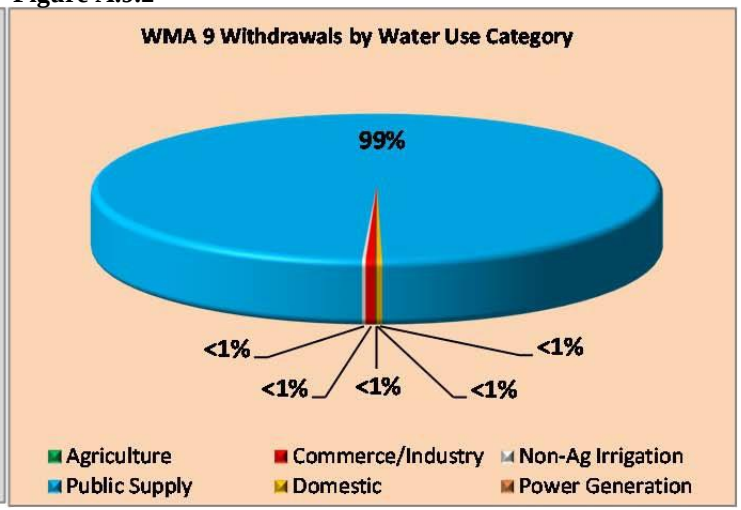


Figure A.9.2



All six water user categories (agriculture, commerce/industry/mining, non-agricultural irrigation, public supply, domestic supply, and power generation) are represented in WMA 9. Withdrawals by water user category in WMA 9 are as follows: public supply— 1,477.12 MGD (96% surface water, 3% unconfined groundwater and 1% confined groundwater); domestic supply – 4.42 MGD (100% unconfined groundwater); agriculture — 0.86 MGD (69% surface water, 20% unconfined groundwater and 11% confined groundwater); commerce/industry/mining – 8.42 MGD (55.5% confined groundwater, 44% unconfined groundwater and 0.5% surface water); non-agricultural irrigation – 3.11 MGD (40% confined groundwater, 31% unconfined groundwater and 29% surface water); and power generation – 0.03 MGD (100% unconfined groundwater). Refer to Figures A.9.1 and A.9.2. Note that power generation is considered 100% non-consumptive and does not contribute to reduced water availability.

[7] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Identification of Public Community Water System's Sources

Table 7.9.1 lists the purveyors that serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 9. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.9.3.

Table A.9.1

Purveyor	Raritan River Lower (Millstone to NB/SB)	Raritan River Lower (Lawrence to Millstone)	Lawrence Brook	Manalapan Brook	Matchaponix Brook	Raritan River Lower (below Lawrence)
East Brunswick Water Utility			U	C/U		
Englishtown Water Department					C	
Freehold Borough Water Department					C	
Freehold Twp. Water Department					C	
Gordons Corner Water Company					C	
Marlboro MUA						C
Middlesex Water Company		U				
Monroe Twp. MUA				C/U		
New Brunswick Water Department			S			
New Jersey American Water Company - Elizabethtown	S/U	U				
New Jersey American Water Company		U				
New Jersey American Water Company - Jamesburg				U		
Old Bridge MUA						U
Perth Amboy Water Department						C/U
Sayreville Water Department						S/U
South River Water Department						U
Spotswood Water Department				U		
United Water Matchaponix					C/S	

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Withdrawal Trends of Major Safe Yield Based Water Systems with Surface Water Withdrawals within WMA 9

In WMAs 8, 9 and 10, the New Jersey Water Supply Authority (NJWSA) owns and operates a surface water supply complex that supplies a large quantity of water to customers in Middlesex, Hunterdon, Mercer, Somerset, Union, and Monmouth Counties. This complex is composed of three facilities: Spruce Run Reservoir, Round Valley Reservoir, and the Delaware & Raritan Canal. Together, these resources operated by the NJWSA have a combined safe yield of 241 MGD (Spruce Run and Round Valley reservoirs = 176 MGD) and (Delaware & Raritan Canal = 65 MGD).

Spruce Run Reservoir is located on the Spruce Run just north of Clinton, New Jersey. It has a drainage area of 41 square miles

and a storage capacity of 11 billion gallons. It is filled through natural flow from its two largest tributaries – Spruce Run and Mulhockaway Creek – and discharges into the South Branch of the Raritan River near Clinton. Statutory passing flows of 40 MGD at the USGS gaging station at Stanton and 70 MGD at the USGS stream gage at Manville are required. The Round Valley Reservoir is located just east of Spruce Run Reservoir. It has a storage capacity of 55 BG and is almost entirely reliant on water pumped from the South Branch of the Raritan River at the Hamden Pumping Station, since its drainage area is a mere 5.7 square miles. Water can be released as needed to either the Hamden Pumping Station or the South Branch of Rockaway Creek (a tributary of the Lamington River) by gravity lines.

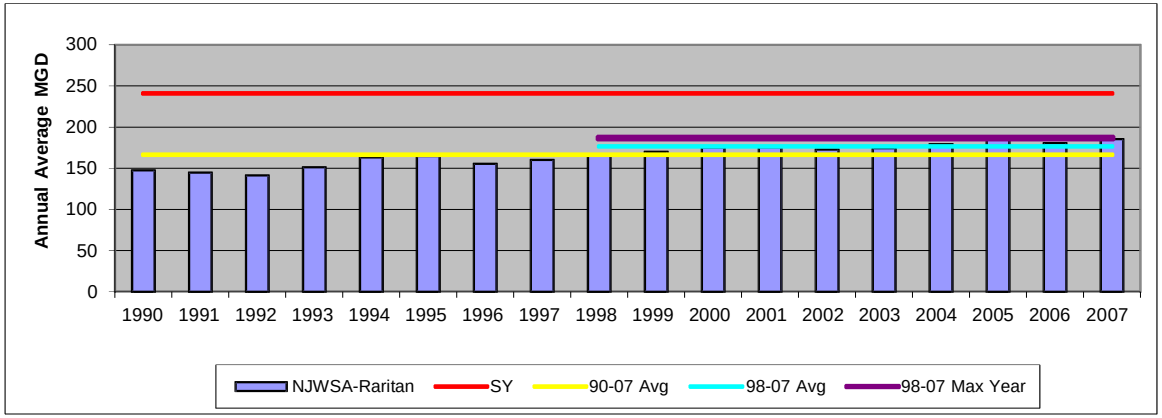
Water released from either reservoir travels downstream to maintain flow at the intake of New Jersey American Water/Elizabethtown Water Company and at the intakes of other users. There is also a required statutory passing flow of 90 MGD at the USGS stream gage at Bound Brook. New Jersey American Water Company (NJAW) – Elizabethtown system owns and operates a public community water supply system that serves a large portion of central New Jersey, including 48 municipalities within the counties of Hunterdon, Mercer, Middlesex, Somerset and Union. NJAW diverts a substantial amount of water from surface water intakes located within WMA 9 at the confluence of the Raritan and Millstone Rivers.

New Jersey Water Supply Authority - Raritan

PWSID: NA

Safe Yield (mgd): 241

90-07 Annual Average Use:	**166.4**	**Unused Safe Yield:**	**74.6**
98-07 Annual Average Use:	**176.6**	**Unused Safe Yield:**	**64.4**
98-07 Maximum Year Use:	**186.8**	**Unused Safe Yield:**	**54.2**



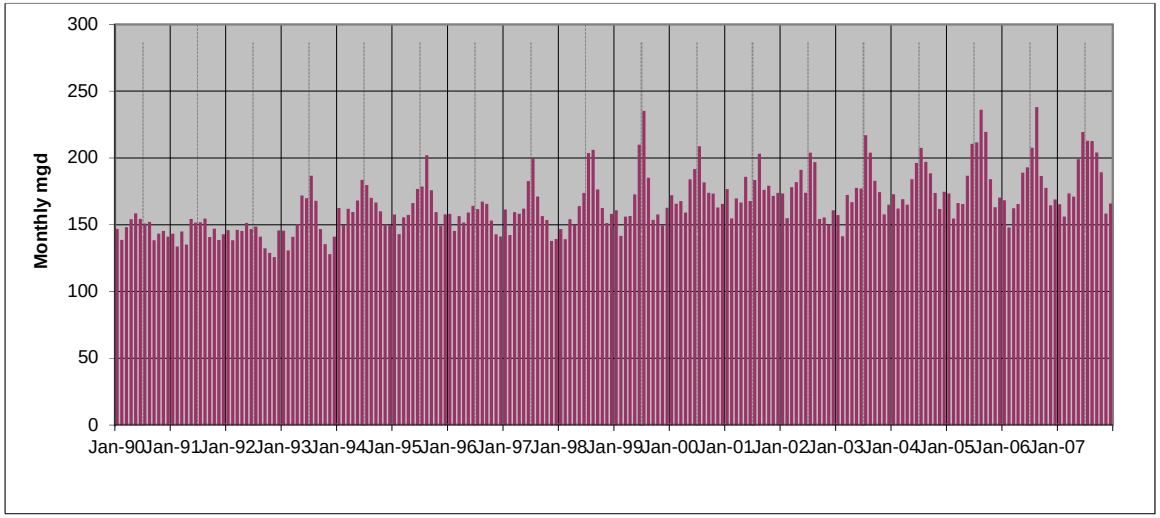
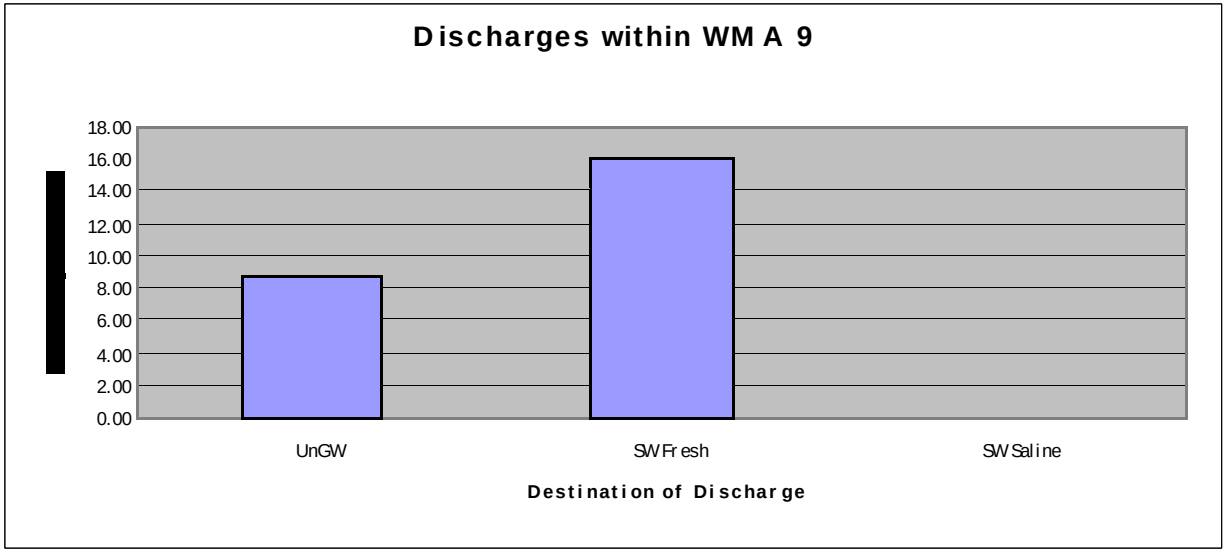


Figure A.9.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.9.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 9:

Table A.9.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030105080	Raritan River Lower (Millstone to NB/SB)	43,656	44,825	46,098	47,604	49,056	50,778
02030105120	Raritan River Lower (Lawrence to Millstone)	348,149	359,943	372,959	386,026	400,618	412,230
02030105130	Lawrence Brook	89,676	93,264	97,198	101,334	106,805	112,433
02030105140	Manalapan Brook	49,046	54,719	57,734	60,591	63,479	66,532
02030105150	Matchaponix Brook	52,832	57,185	60,085	62,724	65,317	67,800
02030105160	Raritan River Lower (below Lawrence)	178,971	185,738	192,703	199,893	208,200	215,442
WMA 9 Total Population		**762,330**	**795,674**	**826,777**	**858,172**	**893,475**	**925,215**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table 7.9.3* shows the additional demand that is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.9.3

HUC 11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030105080	46,098	47,604	0.15	49,056	0.15	50,778	0.17
02030105120	372,959	386,026	1.31	400,618	1.46	412,230	1.16
02030105130	97,198	101,334	0.41	106,805	0.55	112,433	0.56
02030105140	57,734	60,591	0.29	63,479	0.29	66,532	0.31
02030105150	60,085	62,724	0.26	65,317	0.26	67,800	0.25
02030105160	192,703	199,893	0.72	208,200	0.83	215,442	0.72
Totals	**826,777**	**858,172**	**3.14**	**893,475**	**3.54**	**925,215**	**3.17**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.9.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the six HUC 11 watersheds within WMA 9 under three different scenarios -- 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses, and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive (D/C).

Table A.9.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030105080	Raritan River Lower (Millstone to NB/SB)	0.3	-9.6	9.9	-8.0	8.3	9.9
02030105120	Raritan Raritan Lower (Lawrence to Millstone)	3.4	19.3	**-15.9**	35.7	**-32.3**	**-16.6**
02030105130	Lawrence Brook	1.3	6.2	**-4.9**	13.4	**-12.1**	**-4.9**
02030105140	Manalapan Brook	2.6	4.0	**-1.4**	6.6	**-4.0**	**-1.5**
02030105150	Matchaponix Brook	2.5	2.9	**-0.4**	7.0	**-4.5**	**-0.4**
02030105160	Raritan River Lower (below Lawrence)	3.1	12.9	**-9.8**	19.2	**-16.1**	**-10.6**
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

13) New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.

14) The significance of "losses" is explained in more detail under Section 6 below.

15) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The Raritan River Lower (Millstone to NB/SB) HUC11 watershed indicates a significant gain, due largely to the Somerset-Raritan Valley Sewage Authority's wastewater discharge into a small, unnamed swale that flows soon thereafter into Cuckel's Brook. Cuckel's Brook (a tributary to the Raritan River) is located in the adjacent, downstream HUC11 watershed; thus, the apparent gain to the Raritan River Lower (Millstone to NB/SB) HUC11 is misleading since the discharge is at the extreme lower portion of this watershed, and immediately enters and becomes an actual gain to the Raritan River Lower (Lawrence to Millstone) HUC11. If calculated as a "gain" for the Raritan River Lower (Lawrence to Millstone) HUC11 watershed, the identified stress condition for this watershed (see Section 6 below) would likely be reduced.

5) Water Supply Status (Resource Availability)

Table A.9.5 identifies the total resource availability associated with WMA 9. In addition, the table shows 1998-2007 demands, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 9 based on these three scenarios.

Table A.9.5 WMA 5 (Lower Raritan, South River and Lawrence) Available Water and Demand, by source

Source of Water	**Demand & Availability (mgd)**			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	241	187	54	0
run-of-the-river intakes and unconfined groundwater	13	36	-22	-61
confined groundwater	29	17	11	--
sum:	283	240	43	-61

WMA 9 2020 Demand and Availability	
remaining availability	43 mgd
potable use increase by 2020	13.1 mgd
2020 remaining available water	30 mgd

WMA 9 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	2.9 mgd
unbuilt water supply projects	135 mgd

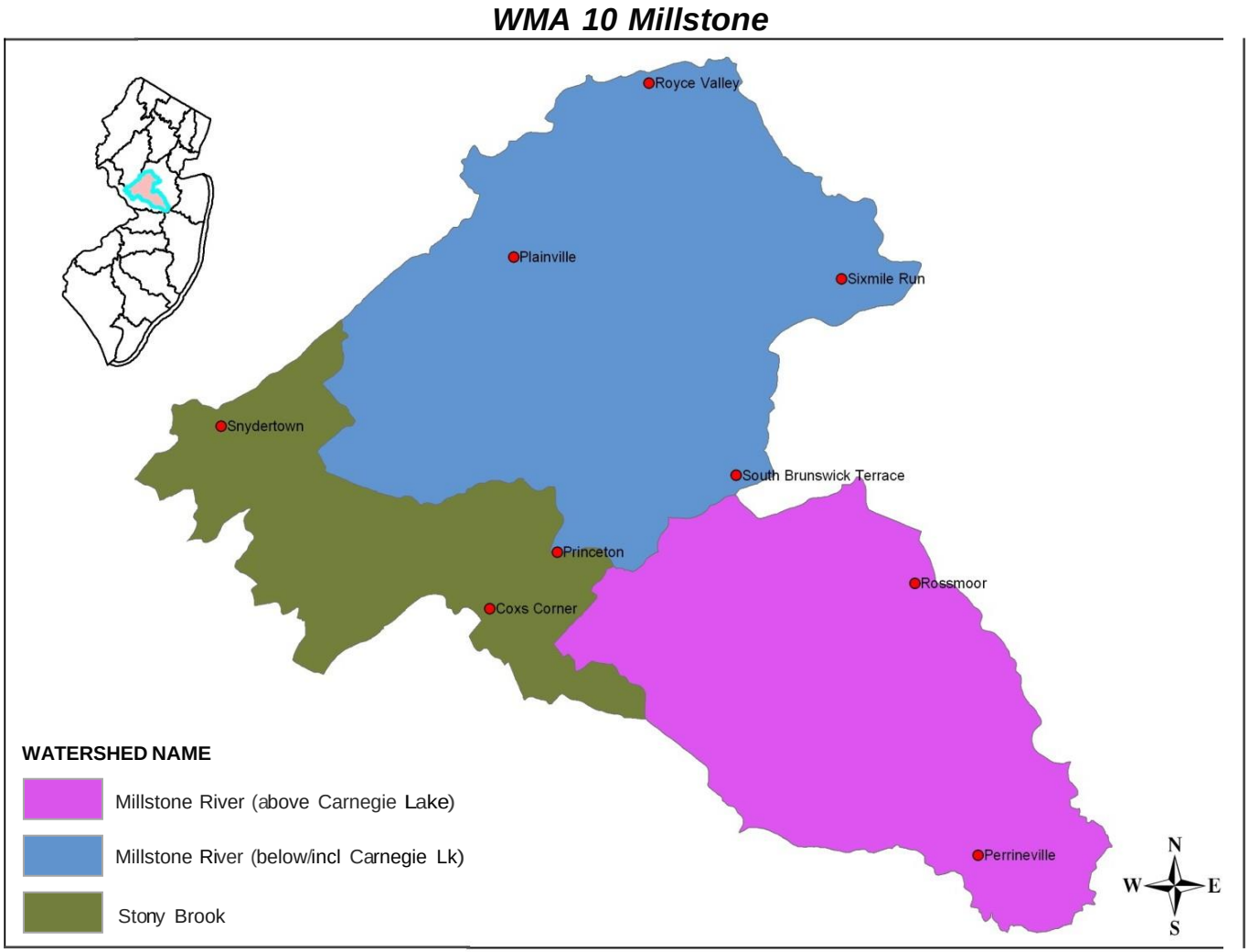
6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

The majority of the HUC11 watersheds in WMA 9 (Lawrence Brook, Manalapan Brook, Matchaponix Brook and Raritan River Lower) are mainly stressed due to the depletive nature of wastewater discharges. The wastewater generated in these watersheds is exported out of the basin to either the Middlesex County Utilities Authority (which discharges to the Raritan Bay/Atlantic Ocean) or Western Monmouth Utilities Authority (which discharges to Pine Brook).

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1). This is particularly critical throughout this WMA since nearly all HUC11 watersheds are stressed.
- Continue to utilize available safe yield from the New Jersey Water Supply Authority and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined groundwater uses.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in WMA 9 should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - As long as the deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield or entering a contract with the New Jersey Water Supply Authority.
- Seek to make the Delaware and Raritan Canal diversion of 85 mgd (applicable under Delaware River Basin Commission-designated drought emergencies) permanent. Currently the one-year Flexible Flow Management Plan (FFMP) program allows the 85 mgd diversion, but without a permanent Decree Party agreement this diversion would revert to the 65 mgd contained in the 1983 Good Faith Agreement.
- Coordinate with Middlesex Water Company to identify the estimated timeframe for initiating the final stage of construction for Middlesex Water Company's South River Basin Pipeline (Policy Item #3).
- Retain properties associated with the Six Mile Run and the Confluence Pump Station and reevaluate the feasibility of developing these properties as a future capital water supply projects (Policy Item # 4).

Watershed Management Area 10: Millstone



Recommended Initiatives for Watershed Management Area 10 Millstone

1) Description of Planning Area

Watershed Management Area (WMA) 10 is located in New Jersey's Piedmont and Coastal Plain physiographic provinces, and includes the Millstone River and its tributaries. The Millstone River itself is a tributary to the Raritan River. WMA 10 lies in parts of Hunterdon, Somerset, Middlesex, Mercer and Monmouth Counties and is 284.4 square miles in size.

The Millstone River is 38 miles long and flows from Millstone Township in Monmouth County to its confluence with the Raritan River near Manville and Bound Brook. Approximately three-quarters of the Millstone River parallels the Delaware and Raritan Canal (D&R Canal) – an important transportation corridor during the 19th century. Both the Millstone River and D&R Canal provide drinking water to portions of central New Jersey. Major tributaries include the Stony Brook, Cranbury Brook, Bear Brook, Ten Mile River, Six Mile Run and Bedens Brook, and the largest impoundment is Carnegie Lake in Princeton. Traditional land uses in the Millstone Watershed primarily have been suburban development and scattered agriculture; however, extensive development is progressively altering the upper portion of the watershed.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 10 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 10, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 34.42 MGD, of which 64% was diverted from unconfined groundwater, 9% from surface water and 27% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 22.00 MGD
Surface Water = 1.31 MGD
Regulated Surface Water = 2 MGD[8]
Confined groundwater = 9.11 MGD

[8] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined ground-water withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.10.1

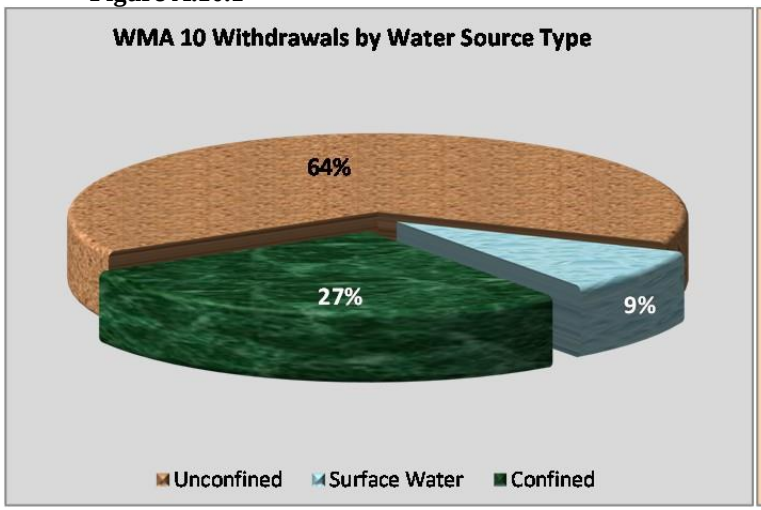
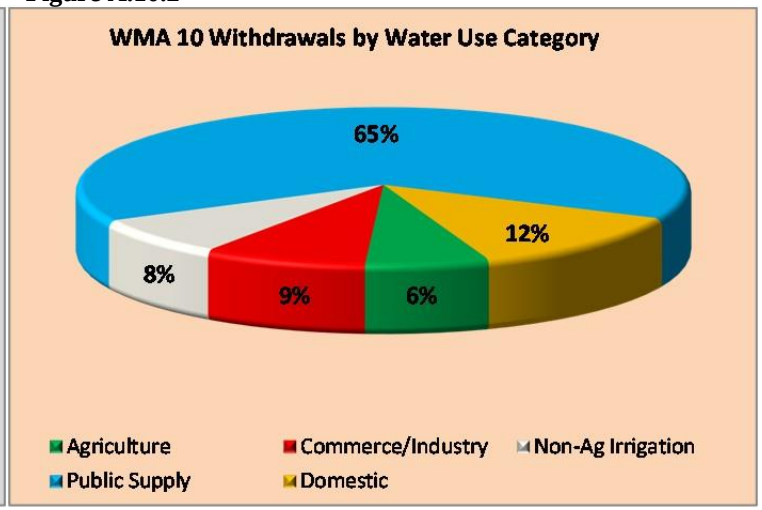


Figure A.10.2



There are five water user types within WMA 10 (potable, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 10 are as follows: public supply – 22.33 MGD (56% unconfined groundwater, 35% confined groundwater and 9% surface water); domestic supply – 4.23 MGD (100% unconfined groundwater); commerce/industry/mining – 2.96 MGD (90% unconfined ground water, 8% confined groundwater and 2% surface water); agriculture – 2.22 MGD (77% unconfined groundwater, 20% surface water and 3% confined groundwater); and non-agricultural irrigation – 2.68 MGD (40% confined and 31% unconfined groundwater and 29% surface water). Refer to Figures A.10/1 and A.10.2.

Identification of Public Community Water System's Sources

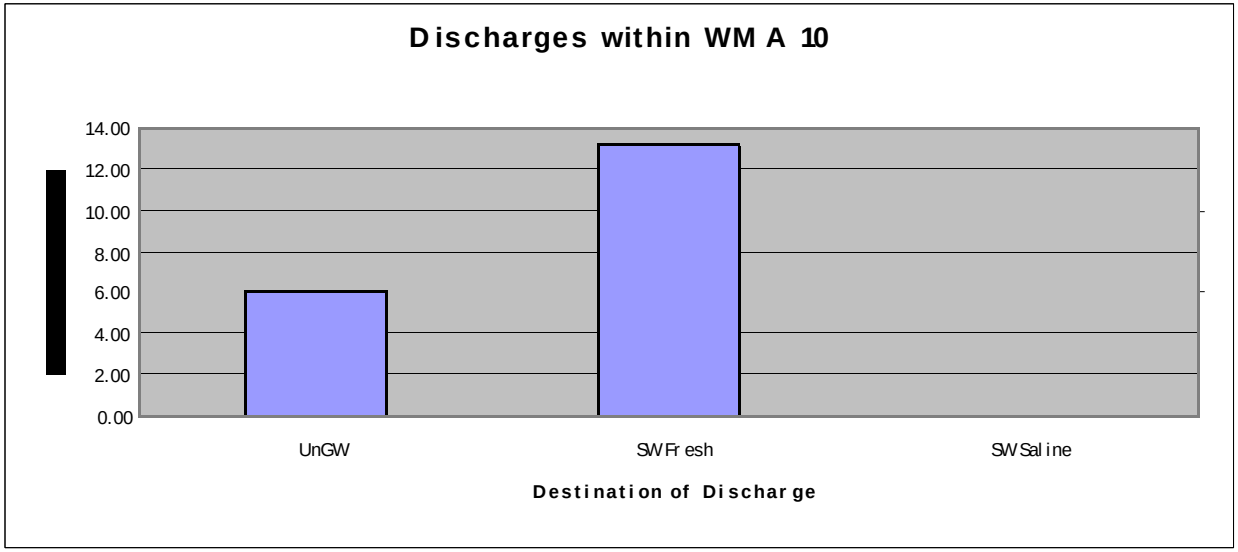
Table A.10.1 lists the purveyors who serve a population of 1,000 people or more and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 10. Diversion types are noted as follows: Unconfined ground water (U); Confined ground water (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.10.3.

Table A.10.1

Purveyor	Stony Brook	Millstone River (above Carnegie Lake)	Millstone River (below/including Carnegie Lake)
East Windsor MUA		C/U	
Hightstown Water Department		U/C	
Hopewell Borough Water Department			U
Monroe Twp. MUA		U	
New Jersey American Water Company - Elizabethtown	U	C/U	U
Pennington Water Department	U		
South Brunswick Twp. Water Division		C/U	

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.10.3 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.10.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 10:

Table A.10.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02030105090	Stony Brook	38,404	40,430	41,250	42,132	43,118	44,366
02030105100	Millstone River (above Carnegie Lake)	85,089	94,409	100,941	105,159	109,535	114,643
02030105110	Millstone River (below/including Carnegie Lake)	118,246	126,729	130,789	136,978	144,059	151,492
WMA 10 Total Population		**241,739**	**261,568**	**272,980**	**284,269**	**296,712**	**310,501**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.10.3* shows the additional demand that is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.10.3

HUC 11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02030105090	41,250	42,132	0.09	43,118	0.10	44,366	0.13
02030105100	100,941	105,159	0.42	109,535	0.44	114,643	0.51
02030105110	130,789	136,978	0.62	144,059	0.71	151,492	0.74
Totals	**272,980**	**284,269**	**1.13**	**296,712**	**1.25**	**310,501**	**1.38**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.10.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the three watersheds within WMA 10 under three different scenarios -- 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur

in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.10.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030105090	Stony Brook	0.8	1.5	**-0.7**	4.0	**-3.2**	**-0.7**
02030105100	Millstone River (above Carnegie Lake)	3.6	9.7	**-6.1**	23.5	**-19.9**	**-7.1**
02030105110	Millstone River (below/including Carnegie Lake)	3.2	-6.1	9.4	-4.1	7.3	9.4

Notes:

16) The significance of "losses" is explained in more detail under Section 6 below.

17) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

5) Water Supply Status (Resource Availability)

Table A.10.5 identifies the total resource availability associated with WMA 10. In addition, the table shows 1998-2007 demands, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 10 under each of these three scenarios.

Table A.10.5 WMA 5 (Millstone) Available Water and Demand, by source

Source of Water	**Demand & Availability (mgd)**			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	8	5	3	-16
confined groundwater	9	6	2	--
sum:	17	11	5	-16

WMA 10 2020 Demand and Availability	
remaining availability	5 mgd
potable use increase by 2020	5.5 mgd
2020 remaining available water	-1 mgd

WMA 10 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	0.5 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

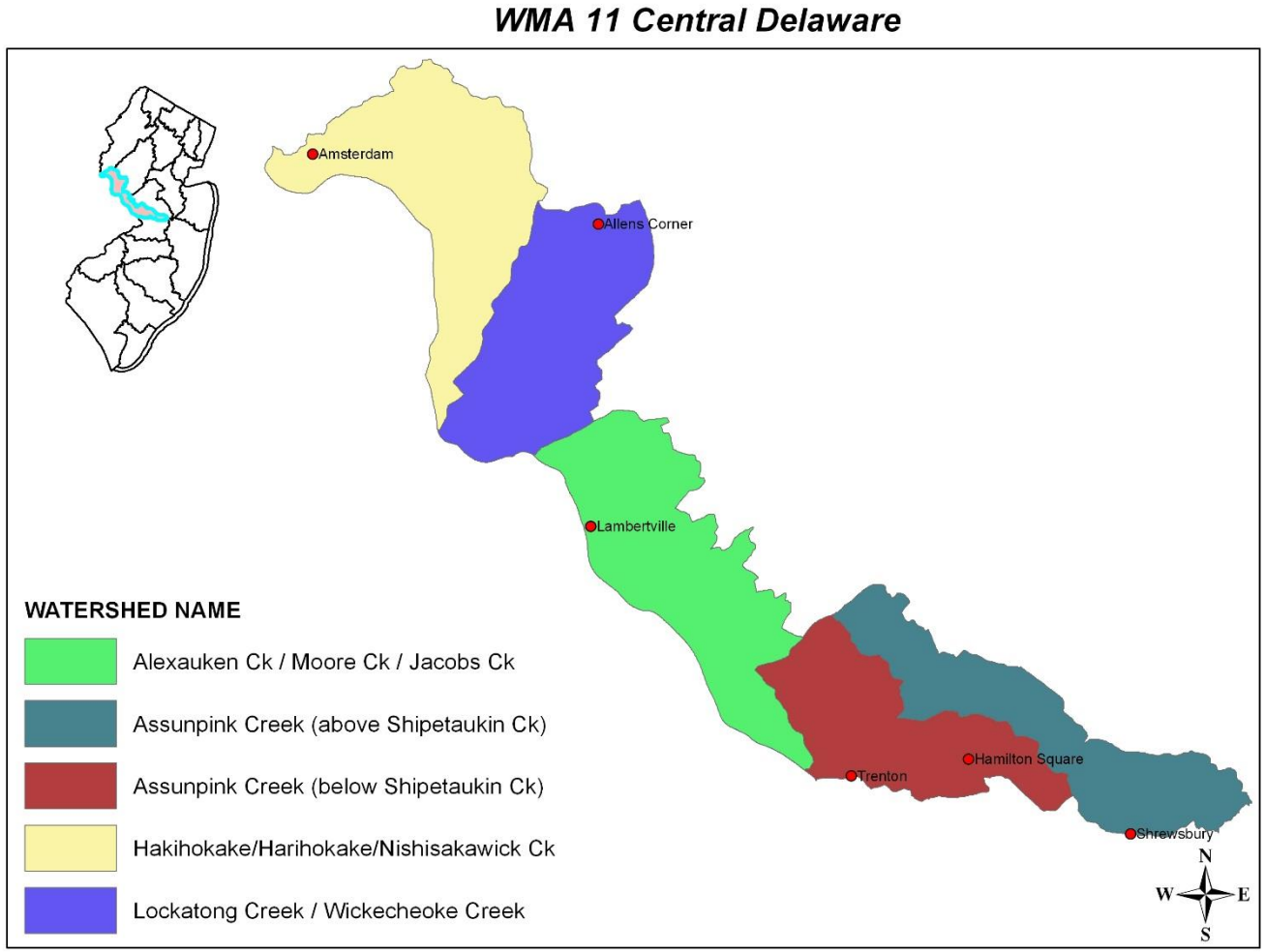
As shown in *Table 7.10.4*, the Stony Brook and Millstone River (above Carnegie Lake) HUC11 watersheds are projected to be in deficit under the full allocation scenario. The deficit in the Stony Brook HUC11 watershed is attributable to a combination of issues. First, there are very small 7Q10's and September Median Flow values limiting the threshold for available water. Secondly, even though the Stony Brook HUC11 watershed imports water from the New Jersey American Water – Raritan system, the HUC11 also exports a comparable amount of generated wastewater (depletive loss) to the Stony Brook Regional Sewage Authority – Hopewell Treatment Plant, which discharges to the Millstone River (below/including Carnegie Lake).

The Millstone River (above Carnegie Lake) HUC11 watershed also shows a deficit due to large exports of sewage to the Stony Brook Regional Sewage Authority - River Road treatment plant, coupled with the additional exports of sewage to the Middlesex County Utility Authority. In addition, the consumptive nature of agricultural irrigation from unconfined ground water also contributes to the deficit condition in the Millstone River (above Carnegie Lake) HUC11 watershed, which becomes even more significant at full allocation.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Millstone River (above Carnegie Lake) HUC11.
- All new depletive/consumptive uses associated with unconfined ground water or unregulated (non-safe yield) surface water in the Stony Brook and Millstone River (above Carnegie Lake) HUC11 watershed should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- Allow no additional depletive/consumptive uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield or entering a contract with the New Jersey Water Supply Authority.
- Utilize available safe yield and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined ground water uses.

Watershed Management Area 11: Central Delaware



Recommended Initiatives for Watershed Management Area 11 Central Delaware

1) Description of Planning Area

Watershed Management Area (WMA) 11 is located in the state's Piedmont and Coastal Plain physiographic provinces, spanning all or parts of 24 municipalities within the counties of Hunterdon, Mercer and Monmouth. The predominant drainage of WMA 11 is to the Delaware River and the Delaware & Raritan (D&R) Canal.

WMA 11 is approximately 269 square miles and includes five HUC11 watersheds: Hakihokake/Harihokake/Nishisakawick Creek, Lockatong Creek/Wickecheoke Creek, Alexauken Creek/Moore Creek/ Jacobs Creek, Assunpink Creek (above Shipetaukin Creek) and Assunpink Creek (below Shipetaukin Creek). Land uses in WMA 11 range from rural to suburban to urban, including the State Capital, Trenton. Suburban development and the ensuing population growth over the past two decades has progressively strained water resource supply and quality.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 11 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 11, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 1,427.77 MGD, of which 0.9% was diverted from unconfined groundwater, 99% from surface water and 0.1% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 13.10 MGD
Surface Water =1.79 MGD
Regulated Surface Water = 1411.81 MGD[9]
Confined groundwater = 1.07 MGD

[9] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.11.1

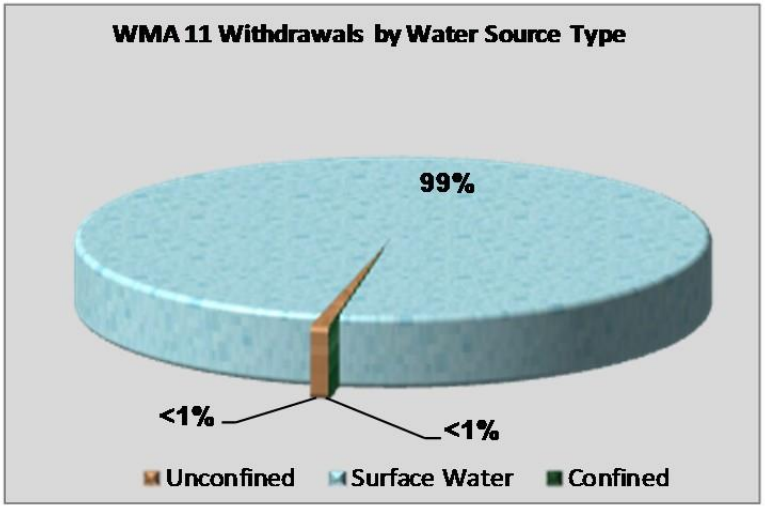
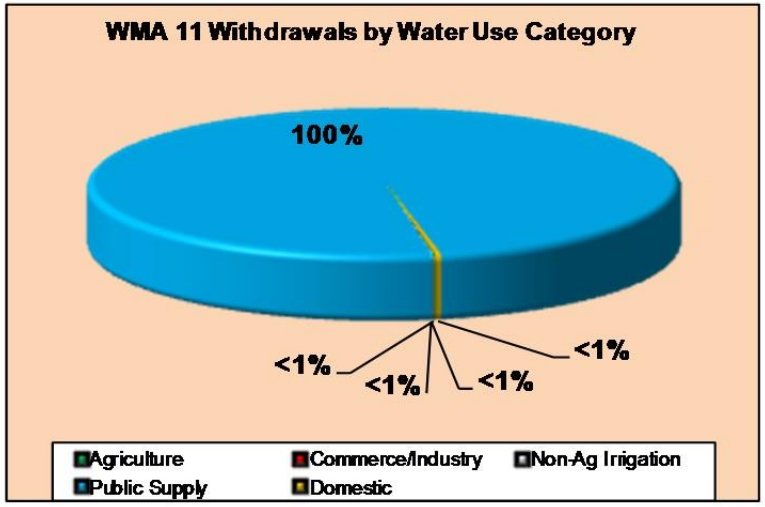


Figure A.11.2



There are five water user types within WMA 11 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 11 are as follows: public supply – 1,420.79 MGD (99.4% surface water, 0.5% unconfined groundwater and 0.1% confined groundwater); domestic supply – 4.35 MGD (100% unconfined groundwater); commerce/industry/mining – 0.38 MGD (74% unconfined groundwater, 17% surface water and 9% confined groundwater); agriculture – 1.61 MGD (54% surface water and 46% unconfined groundwater); and non-agricultural irrigation – 0.65 MGD (68% surface water and 32% unconfined groundwater). Refer to Figures A.11.1 and A.11.2.

Identification of Public Community Water System's Sources

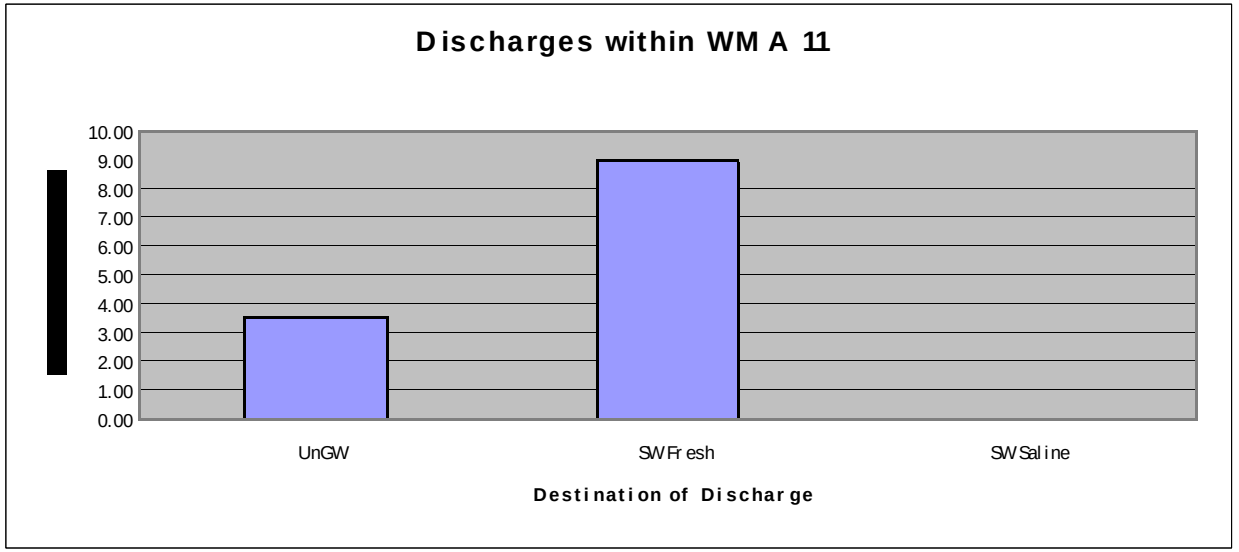
Table A.11.1 lists the purveyors that serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 11. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.11.3.

Table A.11.1

Purveyor	Hakihokake / Harihokake / Nishisakawick Creek	Lockatong Creek / Wickecheoke Creek	Alexauken Creek / Moore Creek / Jacobs Creek	Assunpink Creek (above Shipetaukin Creek)	Assunpink Creek (below Shipetaukin Creek)
Aqua NJ – Hamilton Square					C/U
Lawrenceville School				U	
Lawrenceville Water Company				U	U
Middlesex Water Company		S			
Milford Water Department	U				
New Brunswick Water Department		S			
New Jersey American Water Company – Elizabethtown				C/U	
New Jersey American Water Company - Frenchtown	U				
North Brunswick Water Department		S			
Pennington Water Department			U		
Trenton Water Works			S		
United Water Lambertville			S		

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.11.3 **1998 to 2007 Average NJPDES Discharges by Source**



3) Population and Demand Projections

Table A.11.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 11:

Table A.11.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040105170	Hakihokake/Harihokake/Nishisakawick Creek	12,597	13,286	13,626	14,037	14,568	15,109
02040105200	Lockatong Creek / Wickecheoke Creek	8,433	9,110	9,270	9,552	10,011	10,491
02040105210	Alexauken Creek / Moore Creek / Jacobs Creek	53,501	54,702	55,804	56,567	58,039	59,365
02040105230	Assunpink Creek (above Shipetaukin Creek)	35,738	37,577	39,607	41,041	42,202	43,465
02040105240	Assunpink Creek (below Shipetaukin Creek)	106,762	108,899	111,849	113,332	114,900	116,298
WMA 11 Total Population		**217,031**	**223,574**	**230,156**	**234,529**	**239,720**	**244,728**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.11.3* shows the additional demand that is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.11.3

HUC 11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040105170	13,626	14,037	0.04	14,568	0.05	15,109	0.05
02040105200	9,270	9,552	0.03	10,011	0.05	10,491	0.05
02040105210	55,804	56,567	0.08	58,039	0.15	59,365	0.13
02040105230	39,607	41,041	0.14	42,202	0.12	43,465	0.13
02040105240	111,849	113,332	0.15	114,900	0.16	116,298	0.14
Totals	**230,156**	**234,529**	**0.44**	**239,720**	**0.53**	**244,728**	**0.50**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.11.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the five watersheds within WMA 11 under three different scenarios -- 1998-2007 water use, full allocation, and projected population/water demands for 2020. The values for 1998-2007 and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive (D/C) losses at 1998-2007 use and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 values remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.11.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040105170	Hakihokake/Harihokake/Nishisakawick Creek	2.2	0.9	1.3	1.4	0.8	1.2
02040105200	Lockatong Creek / Wickecheoke Creek	0.7	0.7	0.0	2.0	**-1.3**	0
02040105210	Alexauken Creek / Moore Creek / Jacobs Creek	0.7	0.3	0.4	1.2	**-0.5**	0.4
02040105230	Assunpink Creek (above Shipetaukin Creek)	2.5	2.0	0.5	2.3	0.2	0.5
02040105240	Assunpink Creek (below Shipetaukin Creek)	2.2	-1.7	3.9	-0.3	2.5	3.7
Partially Located Within Highlands		**Wholly Located Within Highlands - see HRMP to obtain water availability**					

Notes:

18) New or increased diversions within HUC11 watersheds located completely or partially within the Highlands will be addressed on a case-by-case basis in cooperation with the Highlands Council.

19) The significance of "losses" is explained in more detail under Section 6 below.

20) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

5) Water Supply Status (Resource Availability)

Table A.11.5 identifies the total resource availability associated with WMA 11. In addition, the table shows the 1998-2007 demands, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 11 under each of these three scenarios.

Table A.11.5 WMA 5 (Central Delaware) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	8	2	6	1.7
confined groundwater	3	2	1	--
sum:	11	4	7	1.7

WMA 11 2020 Demand and Availability	
remaining availability	7 mgd
potable use increase by 2020	2.3 mgd
2020 remaining available water	5 mgd

WMA 11 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	1.0 mgd
unbuilt water supply projects	--

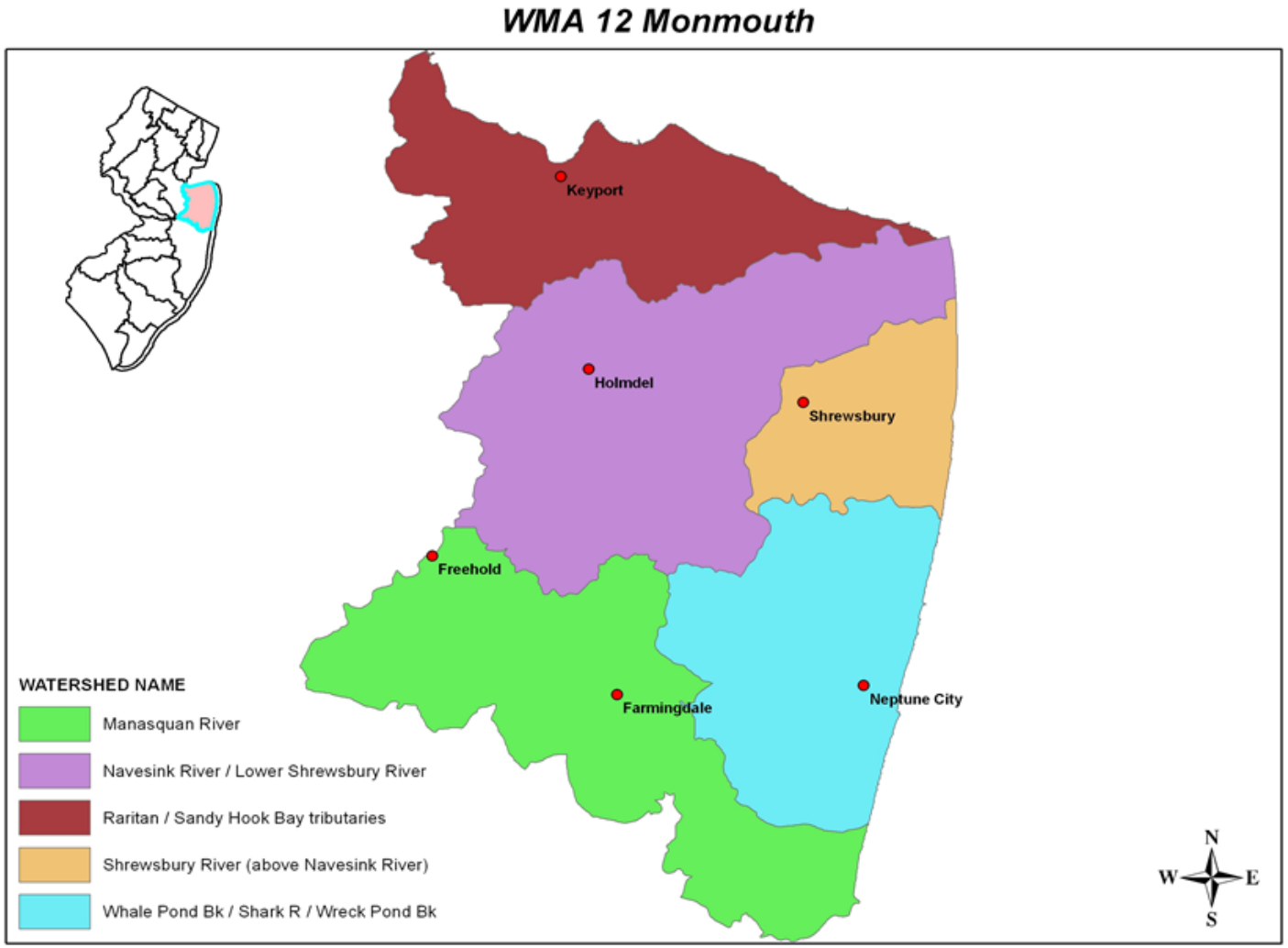
6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

The stresses identified in the Lockatong Creek/Wickecheoke Creek and the Alexauken Creek/Moore Creek/Jacobs Creek HUC11 watersheds under the full allocation scenarios are attributable to a combination of issues. First, there are very small 7Q10 and September Median Flow values limiting the threshold for available water in both watersheds. Also contributing to the identified full allocation stress in the Lockatong Creek/Wickecheoke Creek watershed is the consumptive use associated with agricultural irrigation.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Lockatong Creek/Wickecheoke Creek HUC11 watershed.
- DEP will continue to monitor the Lockatong Creek/Wickecheoke Creek and the Alexauken Creek/Moore Creek/Jacobs Creek HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
  - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.

Watershed Management Area 12: Monmouth



Recommended Initiatives for WMA12, Monmouth

1) Description of Planning Area

Watershed Management Area (WMA) 12 is located in the Coastal Plain Province, extends from Perth Amboy to Point Pleasant Beach and encompasses approximately 534 square miles. WMA 12 is comprised of an assemblage of coastal sub-watersheds, all or a portion of which fall into 56 municipalities in the Raritan Bay and Atlantic Coastal drainage basins. Although the majority of impacted municipalities are in Monmouth County, several lie within the boundaries of Middlesex and Ocean Counties.

Many major water supply issues were identified and resolved in WMA 12 during the 1990's. Due to excessive water use of the confined aquifers in this region, the Department declared a Critical Water Supply Area in 1985 and required significant cutbacks in withdrawal rates (Chapter 3). These cutbacks in Critical Area No. 1 and near-term demand increases were mitigated by the development of the Manasquan Reservoir in WMA 13 by the NJ Water Supply Authority and the conveyance of surface water supplies from WMA 9 to WMA 12 through the Middlesex Water Company's South River Pipeline.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 12 are derived from confined ground water, unconfined ground water and surface water sources. Within WMA 12, the peak annual withdrawal (confined and unconfined ground water, and surface water) during 1998-2007 amounted to 631.45 MGD, of which 2% was diverted from unconfined ground water, 94% from surface water and 4% from confined ground water. The daily water use volume breakdown is as follows:

Unconfined ground water = 10.49 MGD
Surface Water = 1.50 MGD
Regulated Surface Water = 591.67[10]
Confined ground water = 27.79 MGD

[10] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined ground-water withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.12.1

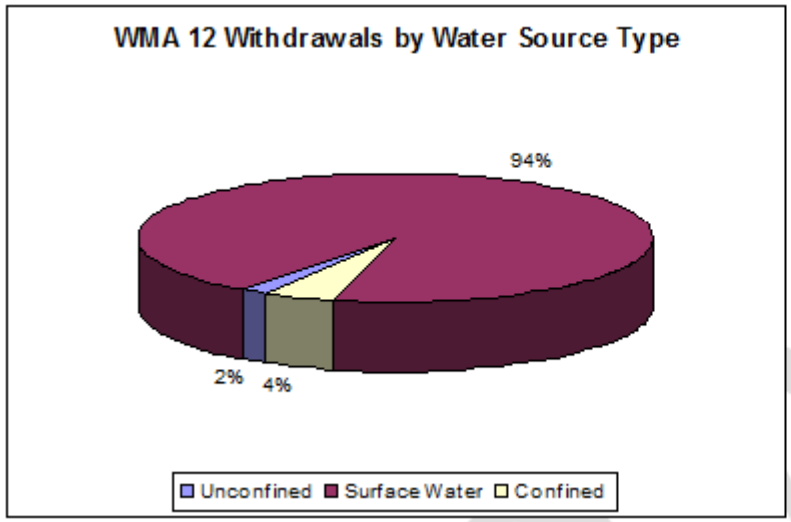
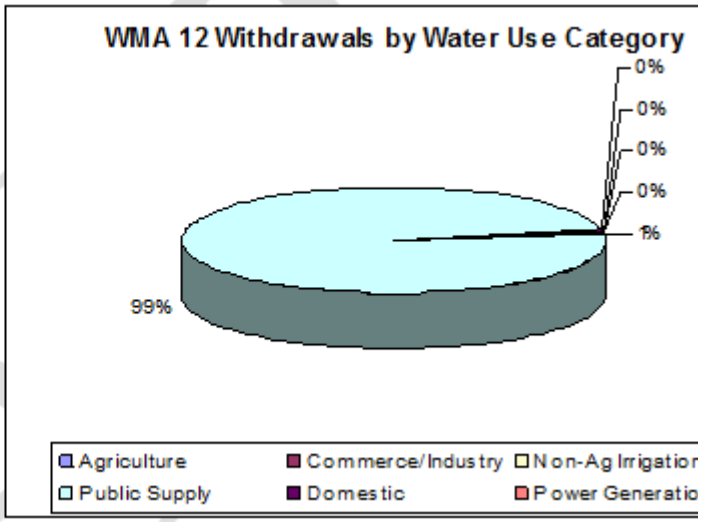


Figure A.12.2



There are five water user types within WMA 12 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water user category in WMA 12 are as follows: public supply -- 621.84 MGD (95% surface water, 4% confined ground water and 1% unconfined ground water); domestic supply – 2.95 MGD (100% unconfined ground water); commerce/industry/mining – 1.91 MGD (91% confined, 8% unconfined ground water and 1% surface water); agriculture – 1.33 MGD (51% surface water, 40% unconfined ground water and 9% confined ground water); and non-agricultural irrigation – 3.42 MGD (57% confined ground water, 23% surface water and 20% unconfined ground water). Refer to Figures A.12.1. and A.12.2.

The principal confined aquifers in Critical Area 1 consist of the Potomac-Raritan-Magothy (PRM) aquifer system, the Englishtown aquifer system, the Wenonah-Mount Laurel aquifer, and the Vincentown aquifer. Most of the water withdrawn from the confined aquifers is from the Upper Potomac-Raritan-Magothy (PRM) with smaller portions coming from the Middle PRM and Lower PRM aquifers. The Department began a re-examination of Critical Area 1 in 2001. As part of a technical reassessment, the US Geological Survey updated and refined its ground-water-flow model of the New Jersey Coastal Plain (Voronin, 2003), using water-use and water-level data from 1999. The model was used to evaluate the potential effects of an increase in pumping from critical aquifers for short periods to alleviate drought stress, examine the effect of increasing pumpage in areas that did not have ready access to the surface-water alternative, and determine if additional supplies could be

extracted from the confined aquifers without contravening the limiting thresholds that were the basis for the initial Critical Area declaration. The model results revealed that no additional water is available from the existing wells in the PRM, Englishtown and MLW aquifers. If wells were to be located in idealized locations, a very small amount (less than 1 MGD) of additional water may be available, but not enough to make a difference. Based on the results of the study, the Department does not intend to make changes to critical area aquifer allocated amounts at this time (either to increase or implement further reductions). For additional information, please refer to the following two USGS technical reports: *Recovery of Ground-Water Levels From 1988 to 2003 and Analysis of Potential Water-Supply Management Options in Critical Area 1, East-Central New Jersey; and Analysis of Effects of 2003 and Full-Allocation Withdrawals in Critical Area 1, East-Central New Jersey*. Both reports are available on the USGS website at http://pubs.usgs.gov/sir/2007/5193/.

Identification of Public Community Water Supply's Sources

Table 7.12.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 within WMA 12. Diversion types are noted as follows: Unconfined ground water (U); Confined ground water (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.12.3.

Table A.12.1

Purveyor	Raritan / Sandy Hook Bay	Navesink River / Lower	Whale Pond Bk / Shark R / Wreck Pond Bk	Manasquan River
Aberdeen – Cliffwood/Cliffwood Beach	C			
Atlantic Highlands Water	C			
Avon By the Sea Water Department			C	
Belmar Water Department			C	
Borough of Spring Lake Heights			C	
Brielle Water Department				C
Farmingdale Water Department				C
Freehold Twp. Water Department				C
Gordons Corner Water Company		C		
Keansburg Water & Sewer Department	C			
Keyport Water Department	C			
Manasquan Water Department				C/U
Matawan Borough Water Department	C			
NJ American Water Coastal North System	C	C/S	C/S	
NJ American Water Company - Union Beach	C			
NJ Water Supply Authority - Manasquan				S
NJ American Water Company Swimming River Plant				C
Old Bridge MUA	U			
Parkway Water Company				U
Point Pleasant Beach Water Department				U
Red Bank Water Department		C		
Sayreville Water Department	U			
Sea Girt Water Department			C/U	
Shorelands Water Company Inc.	C			
Spring Lake Water Department			C	
Wall Twp. Water Department			C	

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Withdrawal Trends of Major Safe Yield Based Water Systems with Surface Water Withdrawals within WMA 12

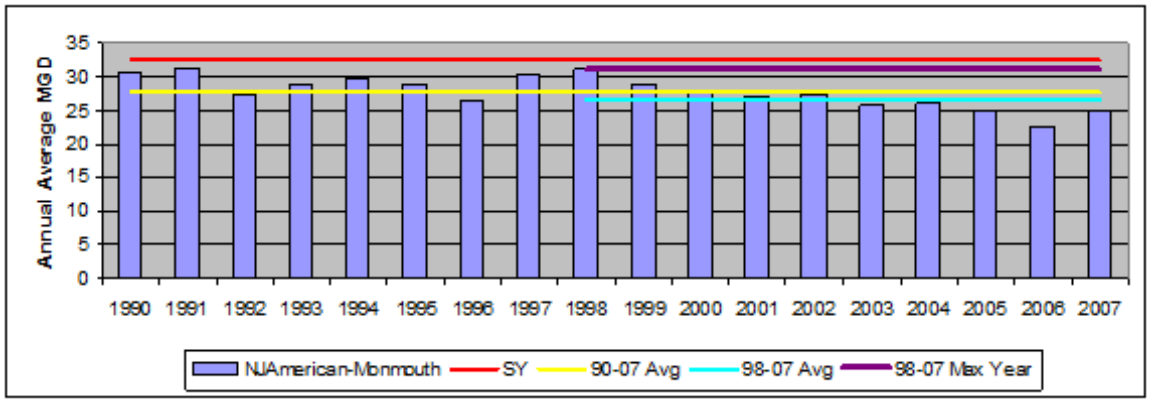
As indicated, diversions from surface water supplies are the main withdrawal type in WMA 12. The largest provider of surface water is the NJ American Water Company – Coastal North System as they divert from the Swimming River (safe yield = 21.5 MGD) and Glendola (safe yield = 11.1 MGD) Reservoirs. In addition, the NJ American Water Company – Coastal North System purchases surface water from the New Jersey Water Supply Authority's Manasquan Reservoir (safe yield = 30 MGD) system in WMA 12, particularly when demands are high. For additional information pertaining to these reservoirs, please refer to Chapter 3.

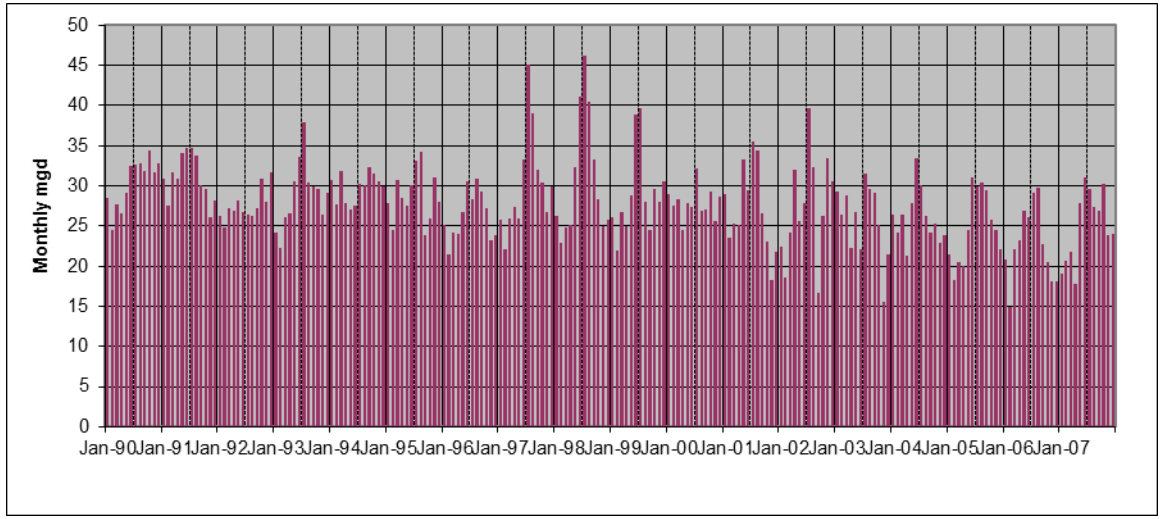
New Jersey American - Monmouth

PWSID: 1345001

Safe Yield (mgd): 32.6

90-07 Annual Average Use: 27.7	**Unused Safe Yield: 4.9**
90-07 Annual Average Use: 26.6	**Unused Safe Yield: 6.0**
98-07 Maximum Year Use: 30.9	**Unused Safe Yield: 1.7**



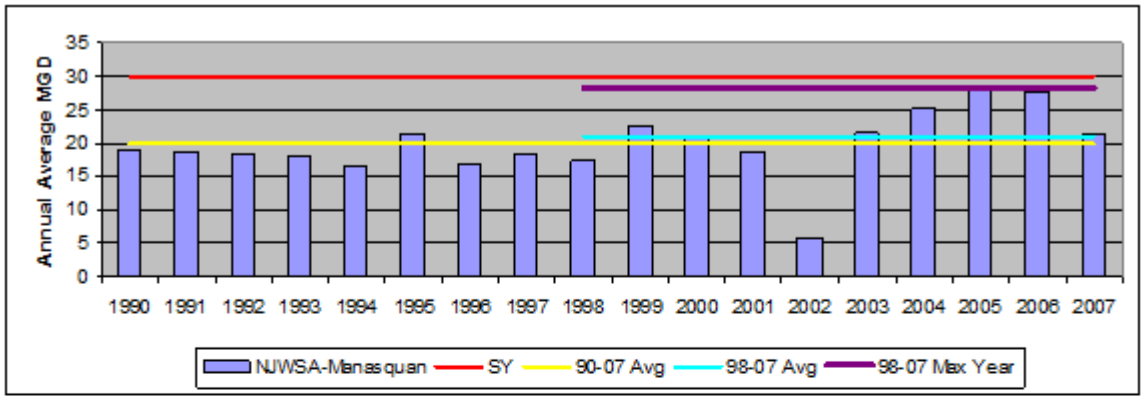


New Jersey Water Supply Authority - Manasquan

PWSID: 1352008

Safe Yield (mgd): 30

90-07 Annual Average Use: 19.8	**Unused Safe Yield: 10.2**
90-07 Annual Average Use: 20.9	**Unused Safe Yield: 9.1**
98-07 Maximum Year Use: 28.3	**Unused Safe Yield: 1.7**



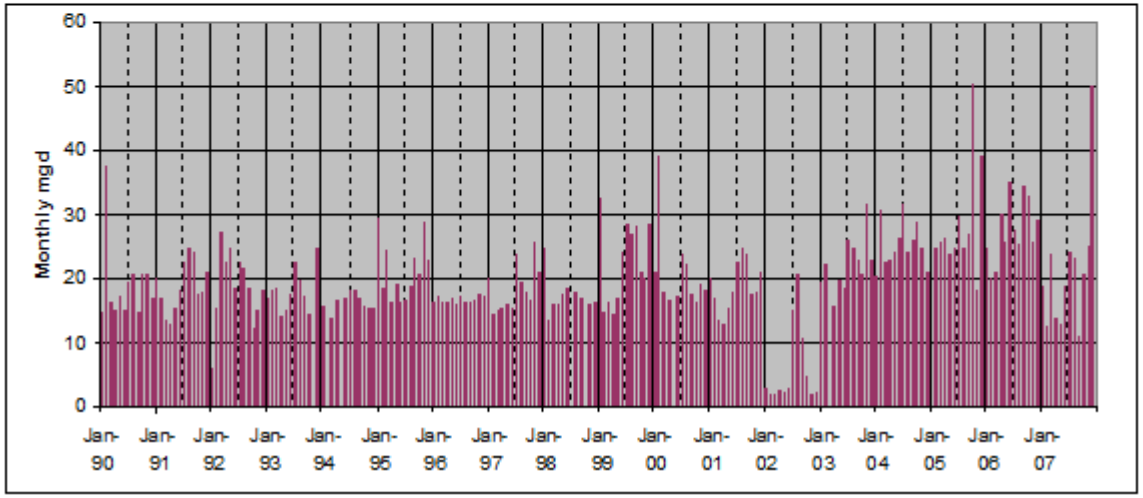
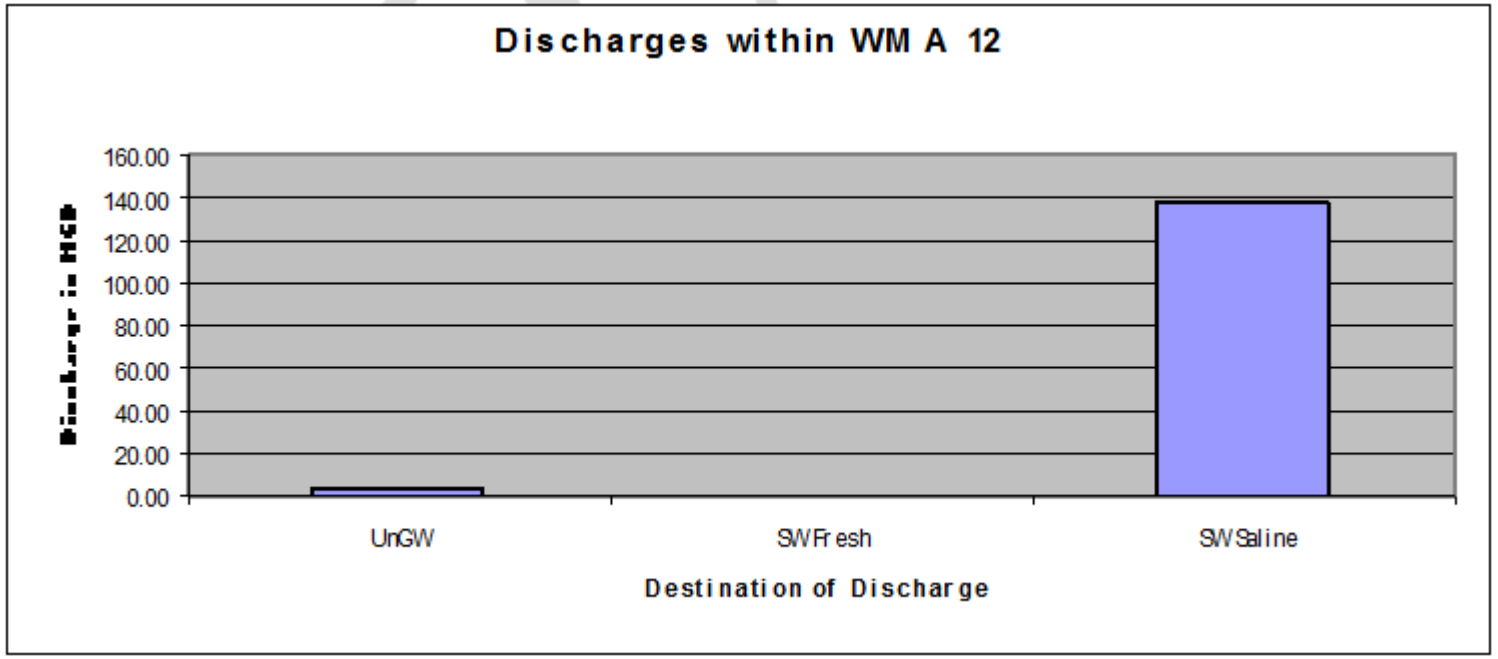


Figure A.13.3 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.*

3) Population and Demand Projections

Table A.12.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 11:

Table A.12.2

Hydrologic Unit Code/Name		**Historic Population by HUC11**			**Projected Population by HUC11**		
		2000	**2005**	**2010**	**2015**	**2020**	**2025**
02030104060	Raritan / Sandy Hook Bay tributaries	143,162	146,893	149,722	152,004	154,832	157,861
02030104070	Navesink River / Lower Shrewsbury River	102,159	105,165	107,386	108,987	111,073	113,755
02030104080	Shrewsbury River (above Navesink River)	70,913	72,905	73,903	74,702	75,156	75,679
02030104090	Whale Pond Brook / Shark River / Wreck Pond Brook	139,288	144,249	148,079	151,306	153,996	156,525
02030104100	Manasquan River	93,576	97,367	101,130	104,929	108,246	111,214
02030104910	Raritan Bay / Sandy Hook Bay	68	69	71	71	71	73
02030104920	Atlantic Coast (Sandy Hook to Whale Pond)	767	785	804	820	835	851
02030104930	Atlantic Coast (Whale Pond to Manasquan)	254	258	261	264	267	270
WMA 12 Total Population		**550,187**	**567,691**	**581,356**	**593,083**	**604,476**	**616,228**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.12.3* shows how much additional demand is estimated for each of the HUC11s in 2015, 2020 and 2025.

Table A.12.3

HUC 11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
2030104060	149,722	152,004	0.23	154,832	0.28	157,861	0.30
2030104070	107,386	108,987	0.16	111,073	0.21	113,755	0.27
2030104080	73,903	74,702	0.08	75,156	0.05	75,679	0.05
2030104090	148,079	151,306	0.32	153,996	0.27	156,525	0.25
2030104100	101,130	104,929	0.38	108,246	0.33	111,214	0.30
2030104910	71	71	0.00	71	0.00	73	0.00
2030104920	804	820	0.00	835	0.00	851	0.01
2030104930	261	264	0.00	267	0.00	270	0.00
Totals	**581,356**	**593,083**	**1.17**	**604,476**	**1.14**	**616,228**	**1.18**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water (Use, Full Allocation and 2020)

*Table A.12.*4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined ground water/unregulated surface water supplies in five of WMA 12's eight HUC11s based on three different scenarios -- 1998-2007 water use, full allocation, and projected population/water demands for 2020. The values based on 1998-2007 demands and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 demands and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely

depletive/consumptive.

Table A.12.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Use in 2020 (MGD)
02030104060	Raritan / Sandy Hook Bay tributaries	4.2	5.5	**-1.3**	0.4	3.8	**-1.5**
02030104070	Navesink River / Lower Shrewsbury River	6.1	2.0	4.1	1.9	4.2	4.1
02030104080	Shrewsbury River (above Navesink River)	2.2	0.5	1.7	0.5	1.7	1.7
02030104090	Whale Pond Brook / Shark River / Wreck Pond Brook	3.4	0.6	2.8	1.6	1.8	2.8
02030104100	Manasquan River	5.1	1.4	3.7	1.7	3.4	3.7

Table A.12.5 identifies the remaining three HUC11s that comprise WMA 12. These HUC11s are not significantly affected by upstream, inland HUC11s. Remaining water available for depletive/consumptive use is calculated the same as for *Table 7.12.5.* However, remaining water available for depletive/consumptive purposes is a false positive in these HUC11s due of the location of wastewater treatment plants which discharge to either the Atlantic Ocean or Raritan Bay. While each of these HUC11s seems to be gaining water that can be used for depletive/consumptive uses, this should not be interpreted as having additional available fresh water. These HUC11s are listed below in order to show that there are opportunities to utilize Reclaimed Water for Beneficial Reuse as a management tool which should be taken advantage of and implemented for all applicable existing and proposed consumptive water uses.

Table A.12.5

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02030104910	Raritan Bay / Sandy Hook Bay	0.0	-98.0	98.0	-98.0	98.0	98.0
02030104920	Atlantic Coast (Sandy Hook to Whale Pond)	0.0	-24.2	24.2	-24.2	24.2	24.2
02030104930	Atlantic Coast (Whale Pond to Manasquan)	0.0	-15.2	15.2	-15.2	15.2	15.2

Note: *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed*

5) Water Supply Status (Resource Availability)

Table A.12.6 identifies the total resource availability associated with WMA 12. In addition, the table shows the 1998-2007 demand, full allocation and estimated 2020 and the corresponding remaining available water supply in WMA 13 under these three scenarios.

Table A.12.6 WMA 12 Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	63	59	3	0
run-of-the-river intakes and unconfined groundwater	21	10	11	15
confined groundwater	29	18	11	0
sum:	113	87	25	15

WMA 12 2020 Demand and Availability	
remaining availability	25 mgd
potable use increase by 2020	5.4 mgd
2020 remaining available water	20 mgd

WMA 12 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	137 mgd
potable conservation savings	4.0 mgd
unbuilt water supply projects	23.2 mgd

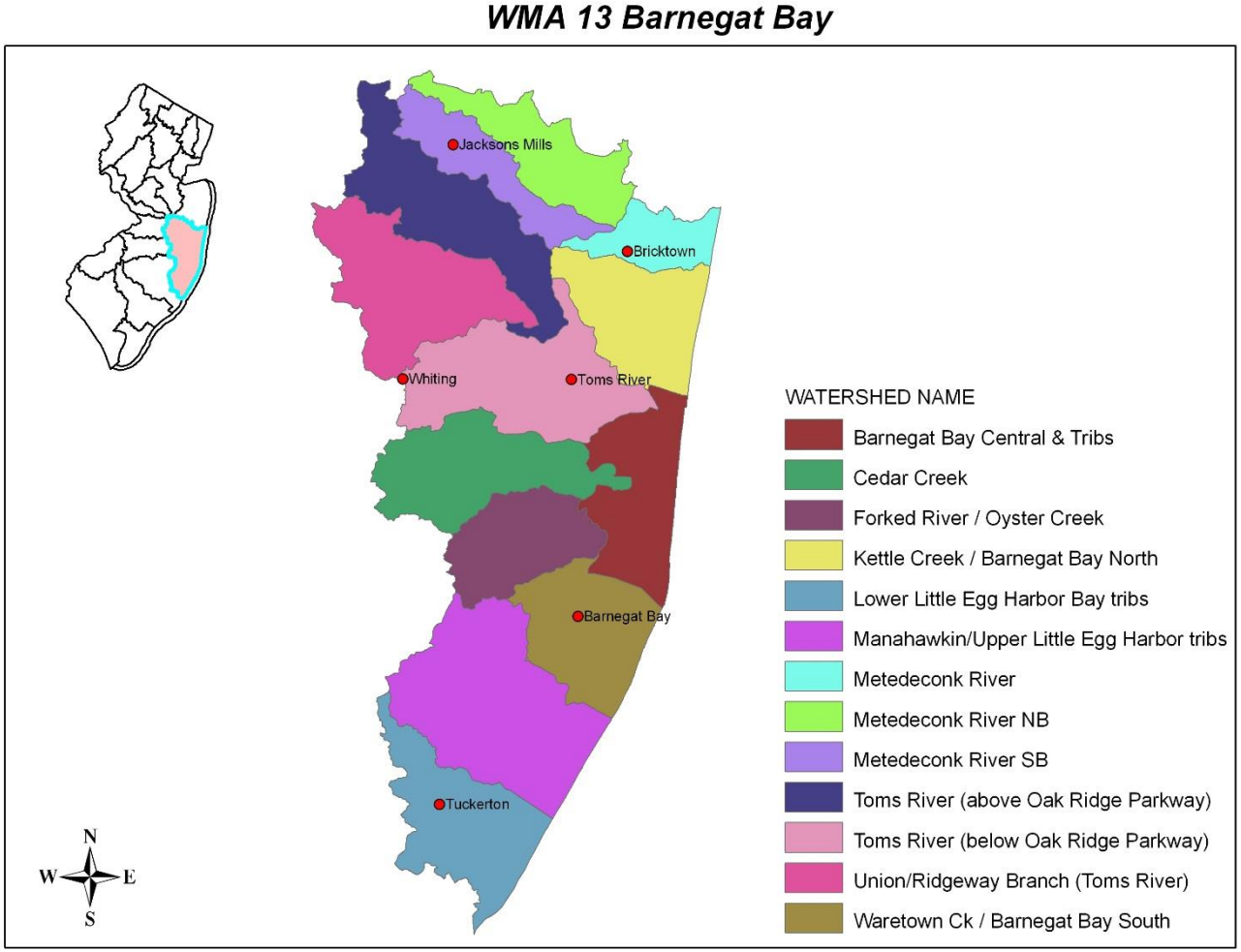
6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

The Raritan/Sandy Hook Bay Tributaries HUC11 is heavily reliant on imported surface water from the NJAWC-Monmouth System and confined groundwater withdrawals. However, the amount of generated wastewater that is discharged to the Atlantic Ocean (depletive loss) is comparable to the amount of water received from NJAWC-Monmouth System and the confined aquifers. Hence, the factor most responsible for causing stress related to unconfined ground water in this HUC11 is the consumptive loss associated with outdoor water uses.

7) Management Options

- Reduce Consumptive Water Loss in the Raritan/Sandy Hook Bay Tributaries HUC11 through Limits on Outdoor Water Use and by Encouraging the use of Advanced Water Efficiency Technology (Policy Item #1)
- Continue to utilize available safe yield from the NJWSA's Manasquan Reservoir and/or interconnections to offset existing and potential depletive/consumptive losses associated with unconfined ground water uses.
- Allow no additional D/C uses above any reservoir, pump station or surface water intake without evaluating the net effect on safe yield.
- Evaluate the use of available water from Middlesex Water Company's D&R Canal diversion as a potential ASR source for Critical Area #1.

Watershed Management Area 13 Barnegat Bay



Recommended Initiatives for Watershed Management Area 13 Barnegat Bay

1) Description of Planning Area

Watershed Management Area (WMA) 13 is located in New Jersey's Coastal Plain and includes 13 HUC11 watersheds that drain to the Atlantic Ocean along New Jersey's central coastal area. Two additional HUC11 watersheds (shown on the map/legend without shading) extend from the shoreline boundary of the contiguous HUC11 watersheds out into the Atlantic Ocean. WMA 13 includes the entire Barnegat Bay watershed, a 660 square mile area encompassing the majority of Ocean County, as well as small portions of Monmouth and Burlington Counties. This WMA is approximately one-half forested, with the remainder constituting a mix of residential/commercial development, a major military facility, and agriculture. Significant surface waters include the Metedeconk, Toms, and Forked Rivers and Cedar Creek.

The Toms River HUC11 watershed drains a 124 square mile area, flowing from western Ocean and Monmouth Counties southeastward to the Barnegat Bay. The larger tributaries of the Toms River HUC11 watershed include Davenports Branch, Union Branch and Wrangle Brook. The Toms River HUC11 watershed also drains a large area of the New Jersey Pinelands. Major impoundments include Success Lake and Horicon Lake. Population centers include Barnegat, Jackson, Lakehurst, Manahawkin (Stafford Twp.), Manchester, and Toms River.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 13 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 13, the peak annual withdrawal (confined and unconfinedground water, and surface water) during 1998-2007 amounted to 196.37 MGD, of which 27% was diverted from unconfined groundwater, 44% from surface water and 29% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 52.83 MGD Surface
Water = 17.02 MGD
Regulated Surface Water = 69.35 MGD[11]
Confined groundwater = 57.17 MGD

[11] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.13.1

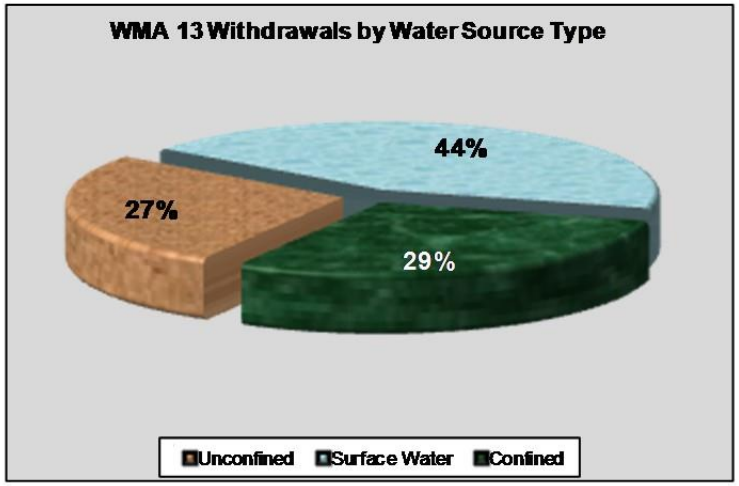
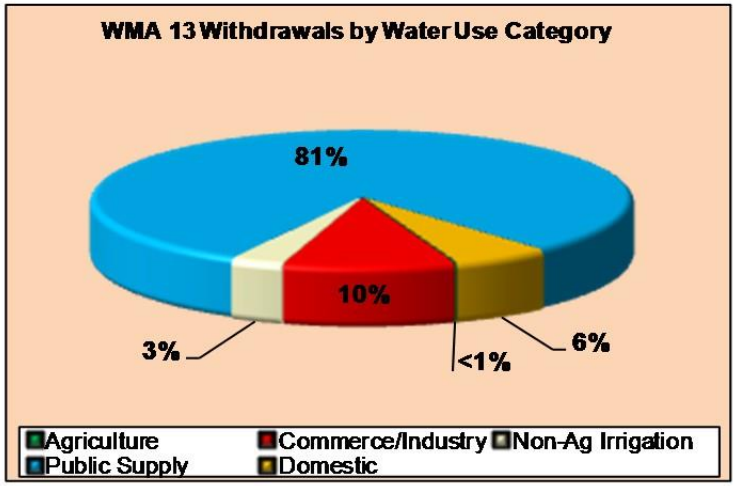


Figure A.13.2



There are five water user types within WMA 13 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 13 are as follows: public supply – 158.64 MGD (44% surface water, 35% confined groundwater and 21% unconfined groundwater); commerce/industry/mining – 20.01 MGD (77% surface water, 23% unconfined groundwater and 2% confined groundwater); domestic supply – 11.47 MGD (100% unconfined groundwater); agriculture – 0.11 MGD (93% unconfined groundwater and 7% surface water); and non-agricultural irrigation – 6.14 MGD (67% unconfined groundwater and 23% surface water and 10% confined groundwater). Refer to Figures A.13.1 and A.13.2.

The confined aquifers considered reliable sources of water in WMA 13 and associated with Critical Area 1 are the (PRM) aquifer system, the Englishtown aquifer system, Piney Point aquifer system, Atlantic City 800 Foot Sands aquifer system, the Rio-Grande Water-bearing zone, the Wenonah-Mount Laurel aquifer and the Vincentown aquifer. The principal confined aquifers in Critical Area 1 consist of the Potomac-Raritan-Magothy (PRM) aquifer system, the Englishtown aquifer system, the Wenonah-Mount Laurel aquifer, and the Vincentown aquifer. Most of the water withdrawn from the confined aquifers is from the Upper Potomac-Raritan-Magothy (PRM) with smaller portions coming from the Middle PRM and Lower PRM aquifers. The Department began a re-examination of Critical Area 1 in 2001. As part of a technical reassessment, the US Geological Survey updated and refined its groundwater flow model of the New Jersey Coastal Plain (Voronin, 2003), using water-use and water-level data from 1999. The model was used to evaluate the potential effects of an increase in pumping from critical aquifers for short periods to alleviate drought stress, examine the effect of increasing pumpage in areas that did not have ready access to the surface water alternative, and determine if additional supplies could be extracted from the confined aquifers without contravening the limiting thresholds that were the basis for the initial Critical Area declaration. The model results revealed that no additional water is available from

the existing wells in the PRM, Englishtown and MLW aquifers. If wells were to be located in idealized locations, a very small amount (less than 1 MGD) of additional water may be available, but not enough to make a difference. Based on the results of the study, the Department does not intend to make changes to critical area aquifer allocated amounts at this time (either to increase or implement further reductions). For additional information, please refer to the following two USGS technical reports: *Recovery of Ground-Water Levels From 1988 to 2003 and Analysis of Potential Water-Supply Management Options in Critical Area 1, East-Central New Jersey; and Analysis of Effects of 2003 and Full-Allocation Withdrawals in Critical Area 1, East-Central New Jersey*. Both reports are available on the USGS website at http://pubs.usgs.gov/sir/2007/5193/.

Identification of Public Community Water Supply's Sources

Table A.13.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 13. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.13.3.

Table A.13.1

Purveyor	Metedeconk River NB	Metedeconk River SB	Metedeconk River	Kettle Creek / Barnegat Bay North	Toms River (above Oak Ridge Parkway)	Union / Ridgeway Branch (Toms River)	Toms River (below Oak Ridge Parkway)	Cedar Creek	Barnegat Bay Central & Tribs	Forked River / Oyster Creek	Waretown Creek / Barnegat Bay South	Manahawkin / Upper Little Egg Harbor tribs	Lower Little Egg Harbor Bay tribs	Atlantic Coast (Manasquan to Barnegat)
Aqua NJ Eastern Division							U	U	U					
Barnegat Light Water Department											C/U	U		
Beach Haven Water Department													C	
Beachwood Water Department							U							
Berkeley Twp. MUA									C/U					
Brick Twp. MUA			C/S/U											
Cedar Glen Lakes Water Company						U								
Crestwood Village Water Company							U							
Harvey Cedars Water Department											C			
Island Heights Water Department							C/U							
Jackson Twp. MUA	C	C			C									
Lacey Twp. MUA								U		U				
Lakehurst Water Department						U								

Purveyor	Metedeconk River NB	Metedeconk River SB	Metedeconk River	Kettle Creek / Barnegat Bay North	Toms River (above Oak Ridge Parkway)	Union / Ridgeway Branch (Toms River)	Toms River (below Oak Ridge Parkway)	Cedar Creek	Barnegat Bay Central & Tribs	Forked River / Oyster Creek	Waretown Creek / Barnegat Bay South	Manahawkin / Upper Little Egg Harbor tribs	Lower Little Egg Harbor Bay tribs	Atlantic Coast (Manasquan to Barnegat)
Lakewood Twp. MUA		C/U	U	C/U										
Lavallette Water Department				C										
Little Egg Harbor Twp. MUA													C	
Long Beach Twp. Brant Beach												C	C	
Long Beach Twp. Water Department													C	
Manchester Twp. Water Utility					U	C/U	U							
Naval Air Engineering Station						C/U								
NJ American Water Company - Ocean			C	C										
NJ American Water Company –	C	C	U	U	C									
Ocean Gate Water Department									C					
Ocean Twp. MUA Pebble Beach											U			
Parkway Water Company	C/U													
Pine Beach Water Department							U							
Pinewood Estates Brighton												U		
Point Pleasant Beach Water			C/U											
Point Pleasant Water Department			C/U											
Seaside Heights Water Department				C/U										
Seaside Park Water Department									C/U					C
Ship Bottom Water Department												C		
Shore Water Company									C/U					
Stafford Twp. MUA Fawn Lake												U		
Stafford Twp Water - Beach Haven												C/U		
Surf City Water Department												C		
Tuckerton Water & Sewer Department													C	
United Water Toms River				C	U		C/U							

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Withdrawal Trends of Major Safe Yield Based Water Systems with Surface Water Withdrawals within WMA 13

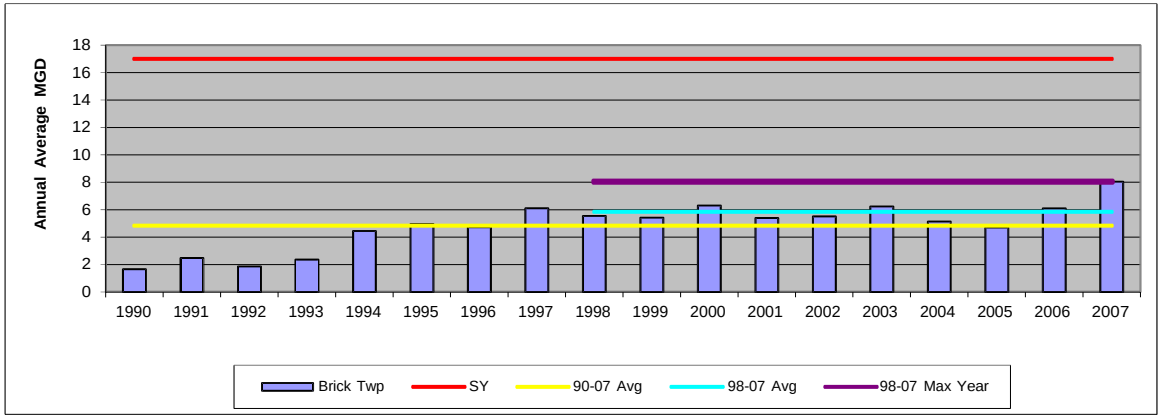
The one significant surface water system in WMA 13 is the Brick Township Municipal Utilities Authority Reservoir. Diversions are for the purpose of public supply and serves Brick Township & Point Pleasant Beach. In addition, portions of Point Pleasant Borough and Howell Township are served via bulk sales. The safe yield of the surface water system is calculated to be 17 MGD.

Brick Township Municipal Utility Authority

PWSID: 1506001

Safe Yield (mgd): 17

90-07 Annual Average Use:	**4.8**	**Unused Safe Yield:**	**12.2**
98-07 Annual Average Use:	**5.8**	**Unused Safe Yield:**	**11.2**
98-07 Maximum Year Use:	**8.1**	**Unused Safe Yield:**	**8.9**



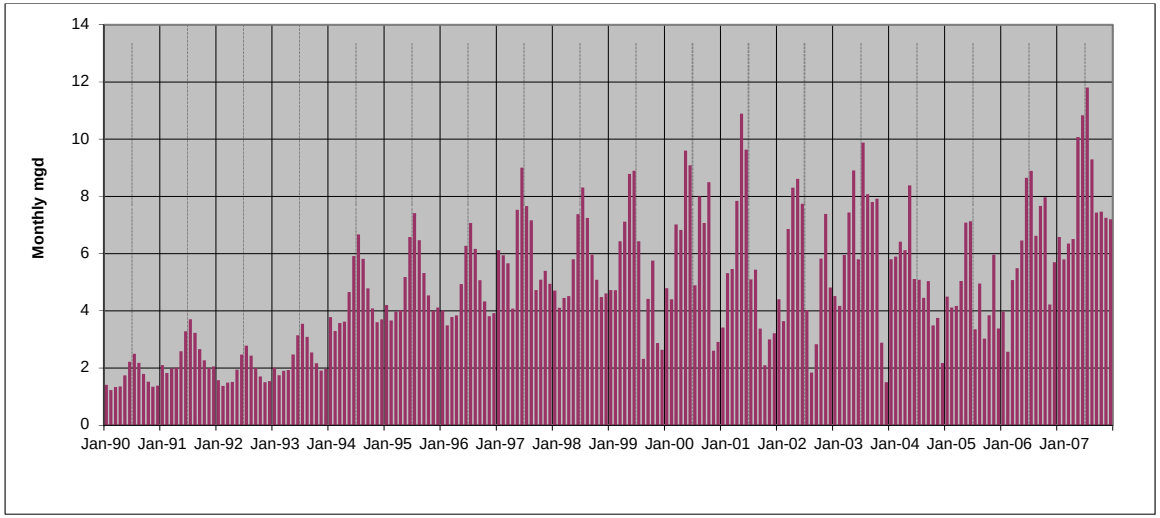
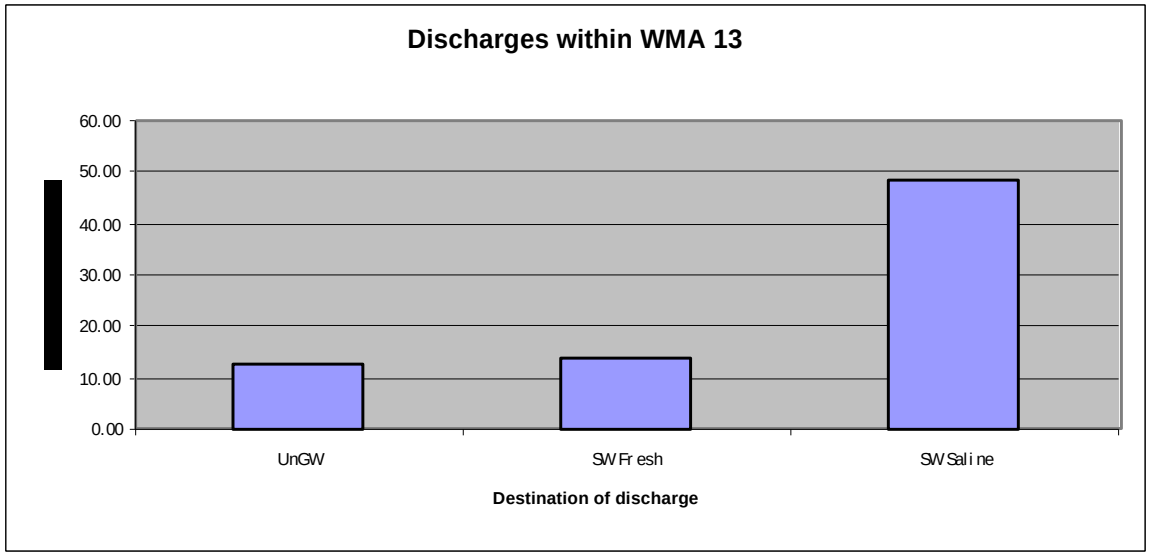


Figure A.13.3 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.*

3) Population and Demand Projections

Table A.13.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 13:

Table A.13.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040301020	Metedeconk River NB	40,345	43,827	46,217	48,475	50,941	53,632
02040301030	Metedeconk River SB	33,386	37,795	40,274	42,500	45,467	49,226
02040301040	Metedeconk River	57,713	59,093	61,558	64,098	66,529	68,259
02040301050	Kettle Creek / Barnegat Bay North	81,587	85,297	88,631	92,465	97,084	101,240
02040301060	Toms River (above Oak Ridge Parkway)	44,200	49,229	53,020	56,939	61,977	67,898
02040301070	Union/Ridgeway Branch (Toms River)	29,149	33,536	36,011	38,704	42,393	47,019
02040301080	Toms River (below Oak Ridge Parkway)	84,428	90,771	92,668	96,082	100,776	105,450
02040301090	Cedar Creek	21,083	22,397	23,673	25,004	26,710	28,602
02040301100	Barnegat Bay Central & Tribs	13,095	14,452	14,935	15,534	16,393	17,400
02040301110	Forked River / Oyster Creek	11,713	12,439	14,125	15,524	17,133	18,938
02040301120	Waretown Creek / Barnegat Bay South	11,516	13,114	14,025	15,121	16,515	18,231
02040301130	Manahawkin/Upper Little Egg Harbor tribs	28,349	31,093	31,795	33,407	36,267	40,280
02040301140	Lower Little Egg Harbor Bay tribs	12,772	14,178	14,925	16,118	17,856	20,123
02040301910	Atlantic Coast (Manasquan to Barnegat)	7,395	7,725	7,988	8,330	8,802	9,278
02040301920	Atlantic Coast (Barnegat to Little Egg)	3,006	3,079	3,115	3,320	3,495	3,670
WMA 13 Total Population		**479,737**	**518,025**	**542,960**	**571,621**	**608,338**	**649,246**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.13.3* shows the additional demand that is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.13.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040301020	46,217	48,475	0.23	50,941	0.25	53,632	0.27
02040301030	40,274	42,500	0.22	45,467	0.30	49,226	0.38
02040301040	61,558	64,098	0.25	66,529	0.24	68,259	0.17
02040301050	88,631	92,465	0.38	97,084	0.46	101,240	0.42
02040301060	53,020	56,939	0.39	61,977	0.50	67,898	0.59
02040301070	36,011	38,704	0.27	42,393	0.37	47,019	0.46
02040301080	92,668	96,082	0.34	100,776	0.47	105,450	0.47
02040301090	23,673	25,004	0.13	26,710	0.17	28,602	0.19
02040301100	14,935	15,534	0.06	16,393	0.09	17,400	0.10
02040301110	14,125	15,524	0.14	17,133	0.16	18,938	0.18
02040301120	14,025	15,121	0.11	16,515	0.14	18,231	0.17
02040301130	31,795	33,407	0.16	36,267	0.29	40,280	0.40
02040301140	14,925	16,118	0.12	17,856	0.17	20,123	0.23
02040301910	7,988	8,330	0.03	8,802	0.05	9,278	0.05
02040301920	3,115	3,320	0.03	3,495	0.02	3,670	0.02
Totals	**542,960**	**571,621**	**2.86**	**608,338**	**3.68**	**649,246**	**4.00**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water (Use, Full Allocation and 2020)

Table A.13.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in thirteen of the fifteen HUC11watersheds in WMA 13 under three different scenarios -- 1998-2007 water use, full allocation, and projected population/water demands for 2020. The values for 1998-2007 demands and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 use and the projected depletive/consumptive(D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.13.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Current (1998-2007) Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040301020	Metedeconk River NB	2.6	1.6	1.0	0.6	2.0	1.0
02040301030	Metedeconk River SB	2.3	1.8	0.4	2.1	0.2	0.4
02040301040	Metedeconk River	1.3	2.7	**-1.4**	2.9	**-1.6**	**-1.5**
02040301050	Kettle Creek / Barnegat Bay North	2.0	4.8	**-2.8**	5.6	**-3.6**	**-3.2**
02040301060	Toms River (above Oak Ridge Parkway)	2.6	5.3	**-2.7**	6.2	**-3.5**	**-2.8**
02040301070	Union/Ridgeway Branch (Toms River)	5.1	3.3	1.8	5.2	**-0.1**	1.6
02040301080	Toms River (below Oak Ridge Parkway)	5.9	11.7	**-5.8**	17.4	**-11.5**	**-6.6**
02040301090	Cedar Creek	8.3	3.3	5.0	3.8	4.5	4.8
02040301100	Barnegat Bay Central & Tribs	5.6	0.5	5.1	0.6	5.0	5.1
02040301110	Forked River / Oyster Creek	3.9	2.5	1.4	3.6	0.3	1.1
02040301120	Waretown Creek / Barnegat Bay South	3.0	2.0	1.0	3.0	**-0.1**	0.7
02040301130	Manahawkin/Upper Little Egg Harbor tribs	5.2	3.4	1.8	6.4	**-1.2**	1.5
02040301140	Lower Little Egg Harbor Bay tribs	1.8	0.9	0.9	1.2	0.5	0.9

Table A.13.5 identifies the remaining two HUC11 watersheds in WMA13. These watersheds are not significantly affected by upstream, inland watersheds. Remaining water available for depletive/consumptive use is calculated the same as for *Table A.13.4.*

The large volume of water shown to be available for depletive/consumptive purposes in the following HUC11 watersheds is misleading because it largely consists of wastewater that is discharged (via separate facilities operated by the Ocean County Utilities Authority) into the Atlantic Ocean. Thus, while each of these HUC11 watersheds appears to be gaining water that could be used for depletive/consumptive uses, this should not be interpreted as additional available fresh water. Nevertheless, these discharges represent a substantial resource to be utilized as Reclaimed Water for Beneficial Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource (prior to its discharge to tidal water) represents an ideal opportunity to meet mitigation objectives where highly consumptive, non-potable water uses currently or are projected to cause stress in one or more HUC11 watersheds.

Table A.13.5

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040301910	Atlantic Coast (Manasquan to Barnegat)	0.0	-41.5	41.5	-41.5	41.5	41.5
02040301920	Atlantic Coast (Barnegat to Little Egg)	0.0	-6.9	6.9	-6.9	6.9	6.9

Notes:

24) The significance of "losses" is explained in more detail under Section 6 below.

25) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

5) Water Supply Status (Resource Availability)

Table A.13.6 identifies the total resource availability associated with WMA 13. In addition, the table shows the 1998-2007 demand, full allocation and estimated 2020 and the corresponding remaining available water supply in WMA 13 under these three scenarios.

Table A.13.6 WMA 13 Available Water and Demand, by source

Source of Water	**Demand & Availability (mgd)**			
	total availability	demand	remaining availability	full allocation remaining availability
surface-water reservoirs	17	8	9	0
run-of-the-river intakes and unconfined groundwater	49	44	6	-9.2
confined groundwater	48	41	7	0
sum:	114	93	22	-9.2

WMA 13 2020 Demand and Availability	
remaining availability	21 mgd
potable use increase by 2020	12.9 mgd
2020 remaining available water	8 mgd

WMA 13 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	48 mgd
potable conservation savings	3.4 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

The stresses triggered by the Low Flow Margin (LFM) methodology in WMA 13, particularly in the Metedeconk River, Kettle Creek / Barnegat Bay North, Toms River (above Oak Ridge Parkway), Toms River (below Oak Ridge Parkway) and Manahawkin/Upper Little Egg Harbor tributaries HUC11s are mainly associated with outdoor lawn/landscape irrigation (consumptive loss) and wastewater discharges to the Atlantic Ocean (depletive loss). Continued development within this region

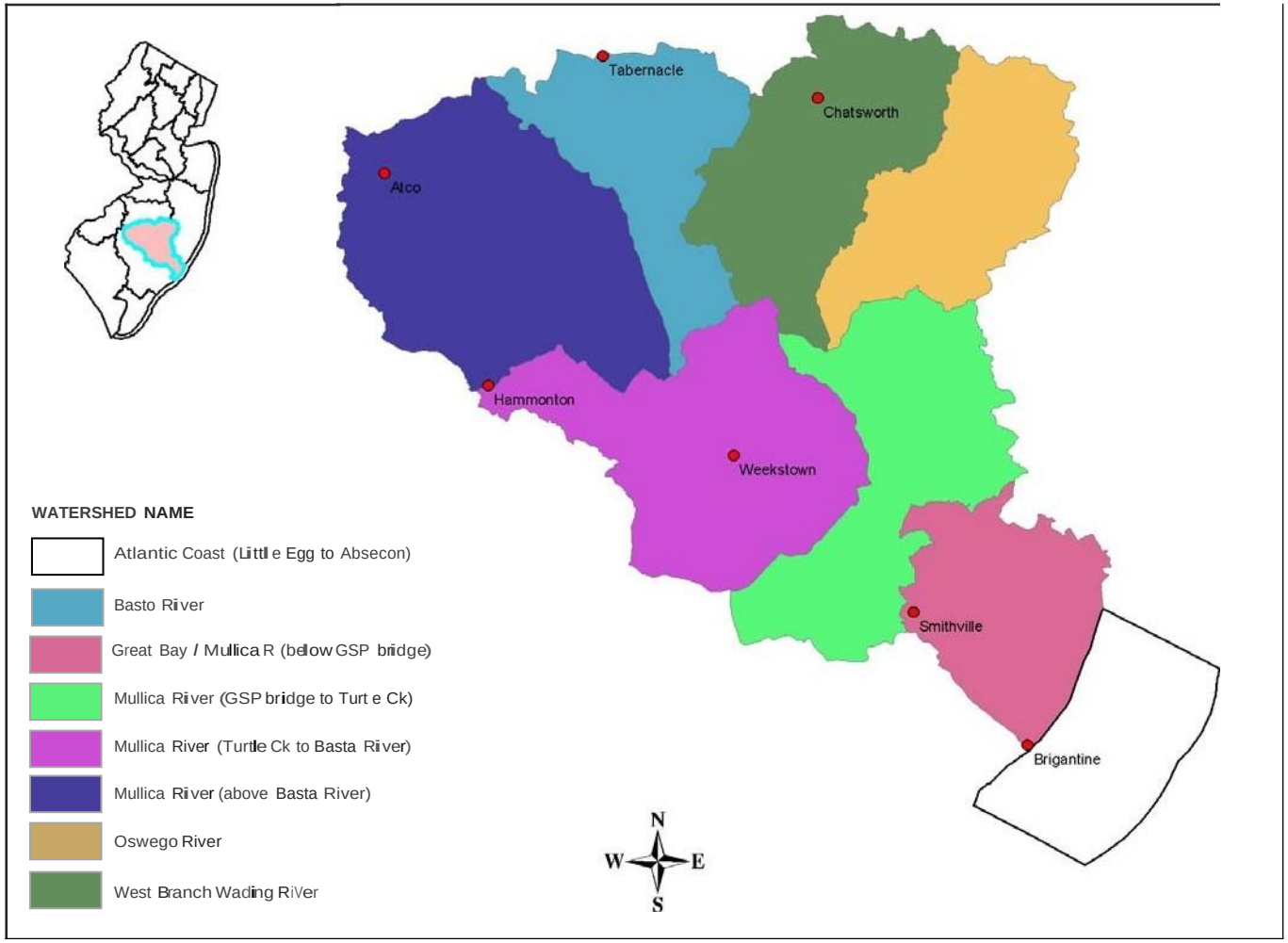
will place additional strains on stressed water reserves. Finally, the Ocean County Northern Pollution Control Facility (OCNPCF) has an extensive sewer service area and a substantial Atlantic Ocean discharge that constitutes a major depletive loss to the watershed.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1), particularly critical to address consumptive water losses in the Metedeconk River, Kettle Creek / Barnegat Bay North, Toms River (above Oak Ridge Parkway), Toms River (below Oak Ridge Parkway) and Manahawkin/Upper Little Egg Harbor tributaries HUC11s.
- All new depletive/consumptive uses associated with unconfined ground water or unregulated (non-safe yield) surface water in the Metedeconk River, Kettle Creek / Barnegat Bay North, Toms River (above Oak Ridge Parkway) and Toms River (below Oak Ridge Parkway) HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses may have to be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Manahawkin/Upper Little Egg Harbor tributaries HUC11 watershed as it approaches the planning threshold for depletive/consumptive uses associated with unconfined ground water or unregulated (non-safe yield) surface water.

Watershed Management Area 14 Mullica River

WMA 14 Mullica



Recommended Initiatives for Watershed Management Area 14 Mullica River

1) Description of Planning Area

Watershed Management Area (WMA) 14 is located in the state's Coastal Plain physiographic province, encompassing approximately 641 square miles throughout portions of Atlantic, Burlington and Ocean Counties. WMA14 includes seven HUC11 watersheds, whose headwaters are located in the heart of New Jersey's Pinelands region, which ultimately flow to the Atlantic Ocean. An additional HUC11 watershed (Atlantic Coast (Little Egg to Absecon)) (shown on the map/legend without shading) extends from the shoreline boundary of the contiguous HUC11 (Great Bay/Mullica River (below GSP Bridge)) out into the Atlantic Ocean.

Primary streams within WMA 14 include the Mullica River, Wading River, Nochescatauxin Brook, Atsion Creek, the Bass River, Batsto River, Nescochaque Creek, Landing Creek, Hammonton Creek and the Oswego River. The streams are classified FW-Pinelands Waters, FW-1, FW-2 Non-trout and SE-1. Much of these waterways are incorporated in the New Jersey Wild and Scenic River System. About 80 percent of this watershed consists of government-owned (municipal/county/State/Federal) parks and forest lands, with the remainder being agricultural and mixed development.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 14 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 14, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 140.12 MGD, of which 49% was diverted from unconfined groundwater, 49% from surface water and 2% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 67.96 MGD
Surface Water = 69.23 MGD
Confined groundwater = 2.93 MGD

Figure A.14.1

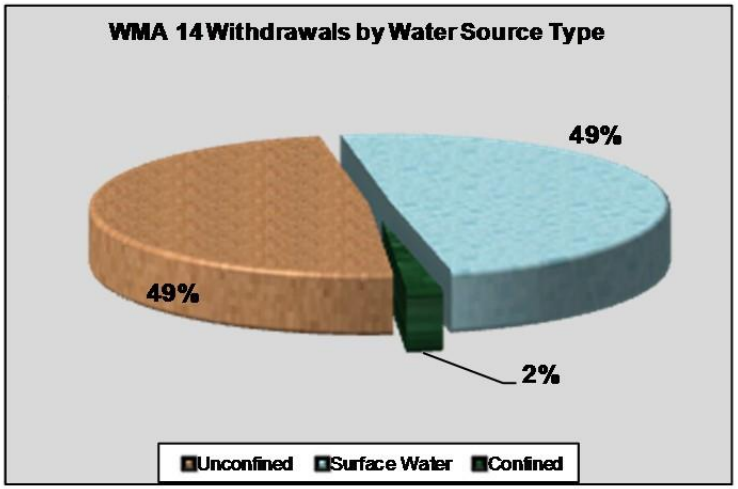
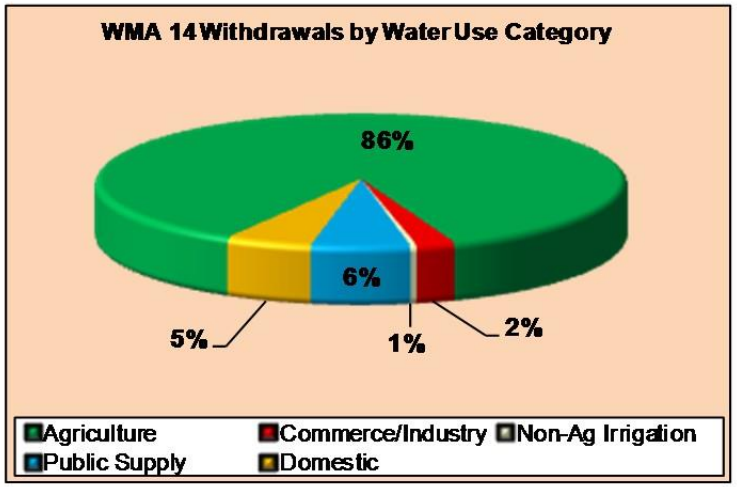


Figure A.14.2



There are five water user types within WMA 14 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 14 are as follows: public supply – 8.38 MGD (67% unconfined groundwater and 33% confined groundwater); domestic supply – 7.42 MGD (100% unconfined groundwater); commerce/industry/mining – 3.29 MGD (58% unconfined groundwater, 41% surface water and 1% confined groundwater); agriculture – 120.48 MGD (56% surface water, 43% unconfined ground water and 1% confined groundwater); and non-agricultural irrigation – 0.55 MGD (100% unconfined groundwater). Refer to Figures A.14.1 and A.14.2.

Aquifers that are present and considered a reliable source of water within the WMA 14 are the Rio-Grande water-bearing zone, Atlantic City 800' Sand aquifer, Piney Point aquifer, Wenonah-Mount Laurel aquifer system, and the Englishtown aquifer system. The Atlantic City 800' Sand aquifer is the principal confined aquifer source for the Atlantic County communities located closest to the Atlantic Ocean. Future withdrawals from the Atlantic City 800' Sand aquifer will be evaluated on a case-by-case basis due to potential regional impacts as the Department is evaluating the use of confined system withdrawals on water-table aquifers in the Pinelands region.

Identification of Public Community Water System's Sources

Table 7.14.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 14. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.14.3.

Table A.14.1

Purveyor	Batsto River	Mullica River (above Batsto River)	Mullica River (Turtle Creek to Batsto River)	Mullica River (GSP bridge to Turtle Creek)	Great Bay / Mullica River (below GSP bridge)
Medford Twp. DMU	C	C			
Ancora Psychiatric Hospital		U			
Winslow Twp. DMU		C/U			
Egg Harbor City Water Department			C/U		
Hammonton Water Department			U		
NJ American Water - Atlantic Division				U	
Brigantine Water Department					C
Little Egg Harbor Twp. MUA					C

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

3) Population and Demand Projections

Table A.14.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 14:

Table A.14.2

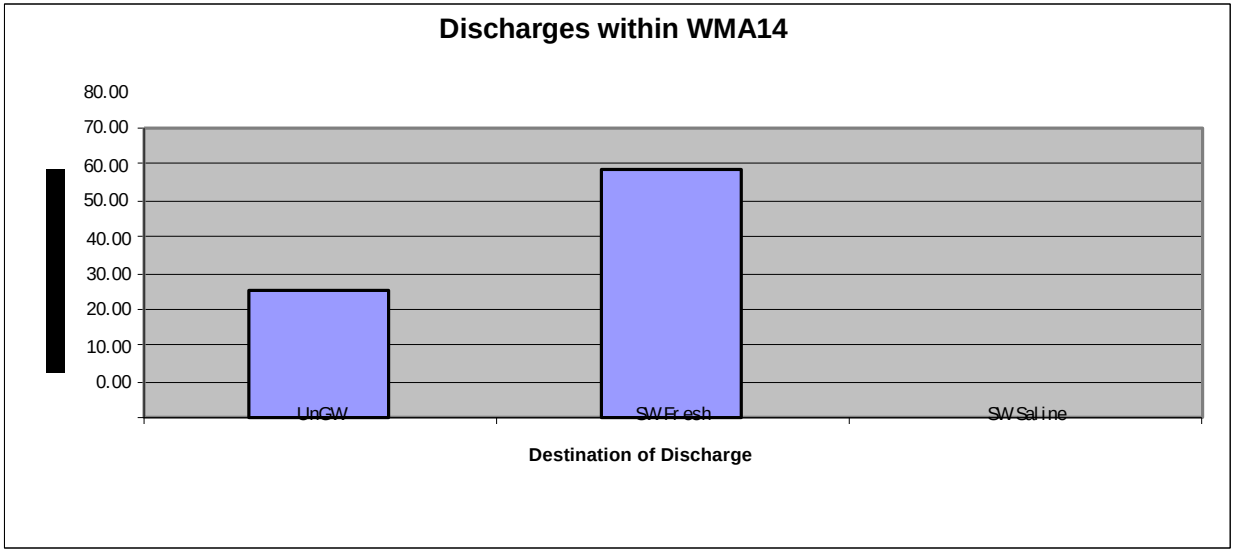
Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040301150	Batsto River	7,795	8,148	8,596	8,924	9,590	10,146
02040301160	Mullica River (above Batsto River)	46,302	48,793	50,716	52,788	54,916	56,748
02040301170	Mullica River (Turtle Ck to Batsto River)	17,215	18,211	19,204	20,332	21,457	22,820
02040301180	Oswego River	12,155	13,968	14,601	15,475	16,771	18,451
02040301190	West Branch Wading River	2,349	2,522	2,656	2,744	2,940	3,130
02040301200	Mullica River (GSP bridge to Turtle Creek)	12,746	14,228	15,537	17,149	18,862	20,967
02040301210	Great Bay / Mullica R (below GSP bridge)	16,777	18,369	19,668	21,281	23,018	25,181
02040302910	Atlantic Coast (Little Egg to Absecon)	1,795	1,835	1,877	1,916	1,955	1,997
WMA 14 Total Population		**117,134**	**126,074**	**132,855**	**140,609**	**149,509**	**159,440**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.14.3* shows the additional demand that is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.14.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040301150	8,596	8,924	0.03	9,590	0.07	10,146	0.06
02040301160	50,716	52,788	0.21	54,916	0.21	56,748	0.18
02040301170	19,204	20,332	0.11	21,457	0.11	22,820	0.14
02040301180	14,601	15,475	0.09	16,771	0.13	18,451	0.17
02040301190	2,656	2,744	0.01	2,940	0.02	3,130	0.02
02040301200	15,537	17,149	0.16	18,862	0.17	20,967	0.21
02040301210	19,668	21,281	0.16	23,018	0.17	25,181	0.22
02040302910	1,877	1,916	0.00	1,955	0.00	1,997	0.01
Totals	**132,855**	**140,609**	**0.78**	**149,509**	**0.89**	**159,440**	**0.99**

Figure A.14.3 1998 to 2007 Average NJPDES Discharges by Source



4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.14.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of WMA 14's seven HUC11s based on three different scenarios -- 1998-2007 demands, full allocation, and projected population/water demands for 2020. The values for 1998-2007 demands and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.14.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040301150	Batsto River	4.4	3.8	0.6	23.2	**-18.7**	0.6
02040301160	Mullica River (above Batsto River)	7.2	9.4	**-2.2**	30.4	**-23.2**	**-2.6**
02040301170	Mullica River (Turtle Creek to Batsto River)	7.7	7.5	0.2	19.6	**-11.9**	0.2
02040301180	Oswego River	4.2	2.6	1.6	1.0	3.2	1.6
02040301190	West Branch Wading River	5.3	3.1	2.3	7.0	**-1.7**	2.3
02040301200	Mullica River (GSP Bridge to Turtle Creek)	6.7	4.5	2.2	7.6	**-0.9**	1.9
02040301210	Great Bay / Mullica River (below GSP bridge)	1.3	0.1	1.2	0.2	1.2	1.2
02040302910	Atlantic Coast (Little Egg to Absecon)	0.0	0.0	0.0	0.0	0.0	0.0

Note: *26) The significance of "losses" is explained in more detail under Section 6 below.*

5) Water Supply Status (Resource Availability)

Table A.14.5 identifies the total resource availability associated with WMA 14. In addition, the table shows the demands (based on 1998-2007 data), full allocation and estimated 2020 demands, and the corresponding remaining available water supply in WMA 14 under these three scenarios.

Table A.14.5 WMA 14 Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	37	31	6	-52
confined groundwater	3	2	1	--
sum:	40	33	7	-52

WMA 14 2020 Demand and Availability	
current remaining availability	7 mgd
potable use increase by 2020	3.2 mgd
2020 remaining available water	4 mgd

WMA 14 Options for Additional Water	
ocean/bay sanitary sewer	--
potable conservation savings	0.4 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

The stresses identified in the Batsto, Mullica River (above Batsto River and Turtle Creek to Batsto River) and West Branch Wading River HUC11 watersheds are primarily based on the consumptive nature of agricultural irrigation. Historically, the volume of water diverted for agricultural use has been substantial, which, coupled with incomplete monitoring/recording of diversion information, hinders the Department's ability to accurately quantify water use within these HUC11 watersheds and compromises the overall water budget analysis. Furthermore, due to various consumptive and non-consumptive uses of water in the cranberry industry and the "double counting" often associated with cranberry water use reporting (see Chapter 2 for more information on agricultural water use), actual agricultural demands in these areas are particularly suspect and are likely to be substantially less than what is reported. Therefore, deficits projected at

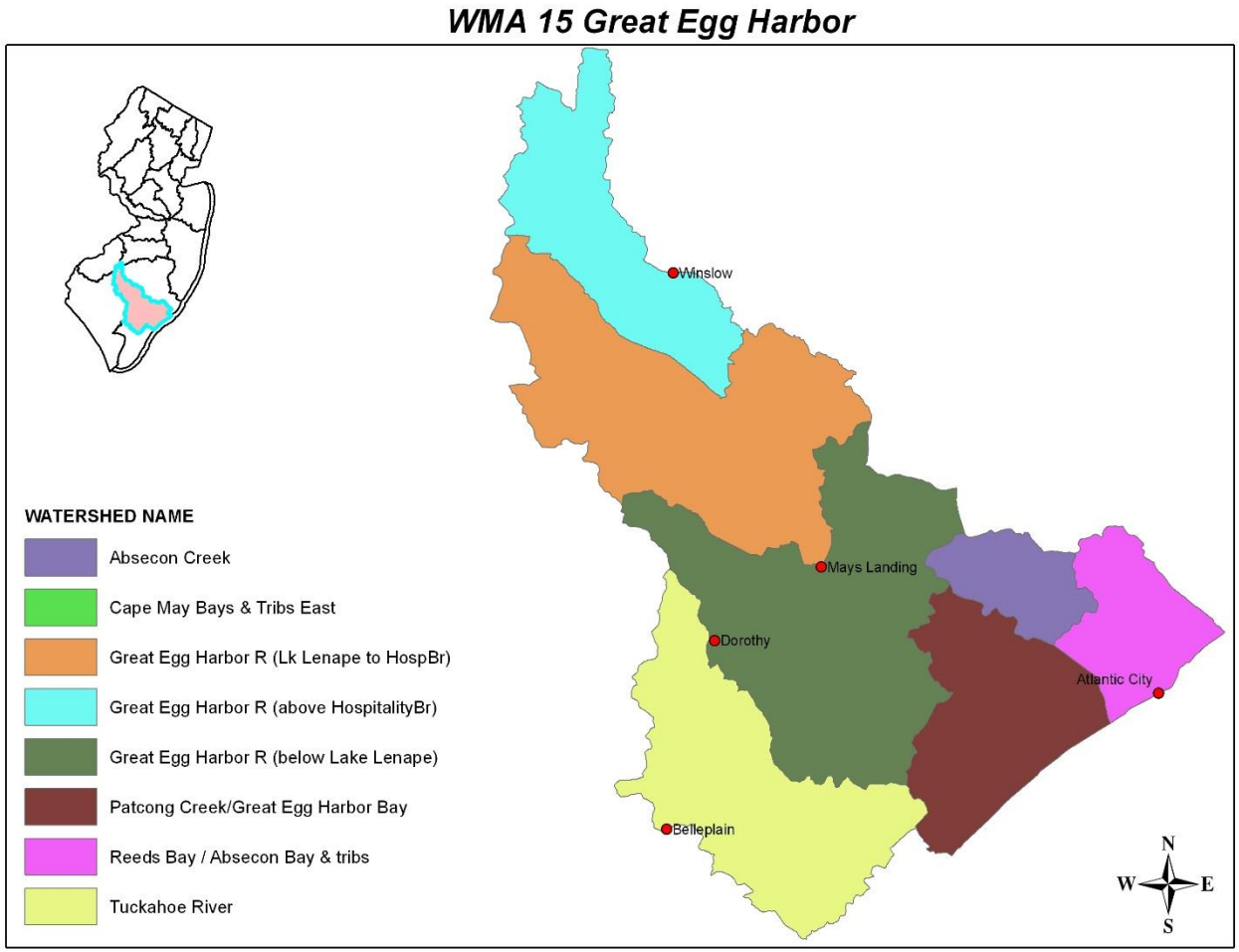
full allocation may be misleading and further analysis is necessary to calculate more realistic allocation limits for cranberry production operations.

Finally, the stress associated with the Mullica River (GSP Bridge to Turtle Creek) HUC11 watershed, is attributable to the transfer (export) of generated wastewater from this HUC11 watershed to the Atlantic County Utilities Authority (ACUA), which discharges to the Atlantic Ocean. As a result, the volume of wastewater discharged by the ACUA is no longer available as a freshwater source. Nevertheless, this discharge represents a substantial resource to be utilized as Reclaimed Water for Beneficial
Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource (prior to its discharge to tidal water) represents an ideal opportunity to meet mitigation objectives where highly consumptive, non-potable water uses currently
or are projected to cause stress in one or more HUC11 watersheds.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Batsto, Mullica River (above Batsto River and Turtle Creek to Batsto River) and West Branch Wading River HUC11s.
- DEP will continue to monitor water use in the Mullica River (GSP bridge to Turtle Creek) HUC11 as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
  - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of an existing depletive/consumptive use, increased storage, or increased recharge.

Watershed Management Area 15 Great Egg Harbor



Recommended Initiatives for Watershed Management Area 15: Great Egg Harbor

1) Description of Planning Area

Watershed Management Area (WMA) 15 is located in New Jersey's Coastal Plain Province, extending southeastward from Gloucester and Camden Counties to the Atlantic Ocean. WMA 15 encompasses approximately 613.5 square miles, and includes seven HUC11 watersheds that flow generally southeastward toward the Atlantic Ocean: Great Egg Harbor River (Above Hospitality Branch, Lake Lenape to Hospitality Branch, and Below Lake Lenape), Tuckahoe River, Patcong Creek/Great Egg Harbor Bay, Absecon Creek, and Reeds Bay/Absecon Bays & tributaries. Two additional HUC11 watersheds (shown on the map/legend without shading) extend from the shoreline boundary of the contiguous HUC11s out into the Atlantic Ocean.

The watershed's dominant land use is forested, with the remainder a mix of agriculture and residential/commercial development. Population centers include Berlin, Winslow, Monroe, Egg Harbor and Hamilton Townships, Pleasantville and Atlantic City. The major tributaries are Hospitality Branch, Watering Race, Babcock Creek, Deep Run, South River and Stephens Creek. There are many lakes and ponds in this area, with the largest being Lake Lenape, an impoundment that spills to the tidal portion of the Great Egg Harbor River at Mays Landing (Hamilton Township).

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 15 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 15, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 119.48 MGD, of which 62% was diverted from unconfined groundwater, 15% from surface water and 23% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 73.84 MGD
Surface Water = 17.66 MGD
Confined groundwater = 27.97 MGD

Figure A.15.1

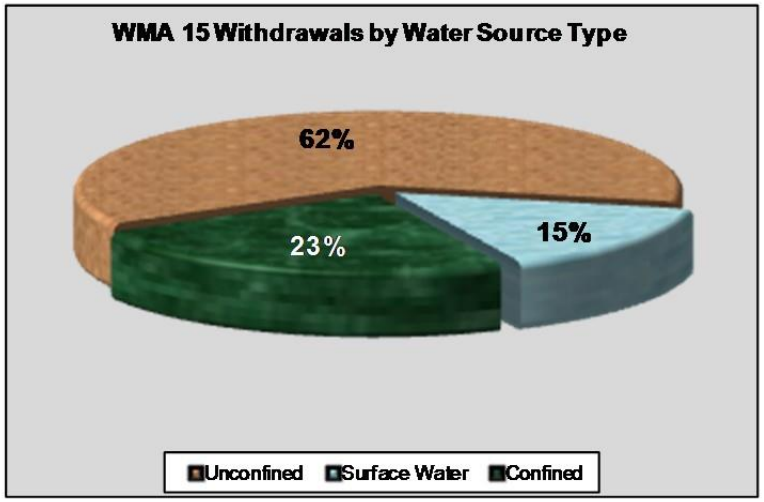
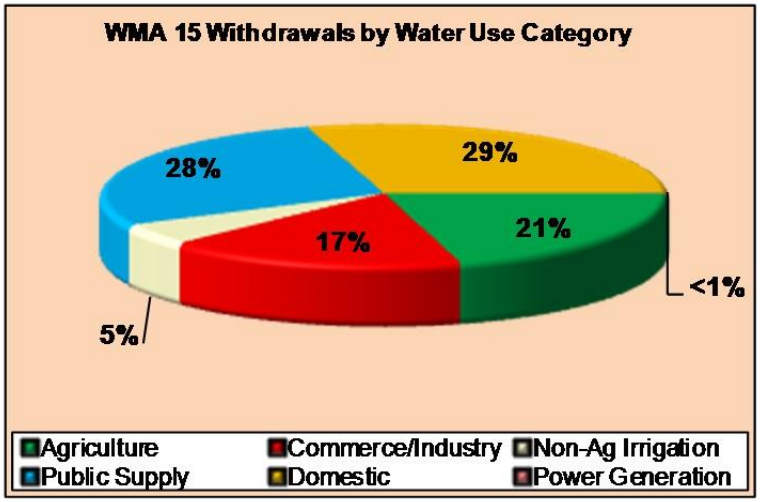


Figure A.15.2



All six water use categories are represented in WMA 15 (public supply, commerce/industry/mining, agriculture, non-agricultural irrigation, domestic supplies and power generation). Withdrawals by water use category in WMA 15 are as follows: public supply -- 59.01 MGD (52% unconfined groundwater, 44% confined groundwater and 4% surface water); domestic supplies – 9.33 MGD (100% unconfined groundwater); commerce/industry/mining – 22.35 MGD (56% surface water, 35% unconfined groundwater and 9% confined groundwater); agriculture – 24.74 MGD (94% unconfined groundwater and 6% surface water); non-agricultural irrigation – 3.96 MGD (58% unconfined groundwater, 39% surface water and 3% confined groundwater); and power generation – 0.09 MGD (100% unconfined confined groundwater). Refer to Figures A.15.1 and A.15.2.

Within WMA 15, the Rio-Grande water-bearing zone, Atlantic City 800' Sand aquifer system, the Wenonah-Mount-Laurel aquifer system, the Piney Point aquifer, and the Englishtown aquifer system are all applicable sources used for potable supplies. The Atlantic City 800' Sand aquifer is the principal confined aquifer source for most community water systems, particularly for those barrier islands towns located along the Atlantic Ocean. Future withdrawals from the Atlantic City 800' Sand aquifer will be evaluated on a case-by-case basis as the Department is evaluating the use of confined system withdrawals on water-table aquifers in the Pinelands region along with saltwater front movement in the Cape May Peninsula.

Identification of Public Community Water System's Sources

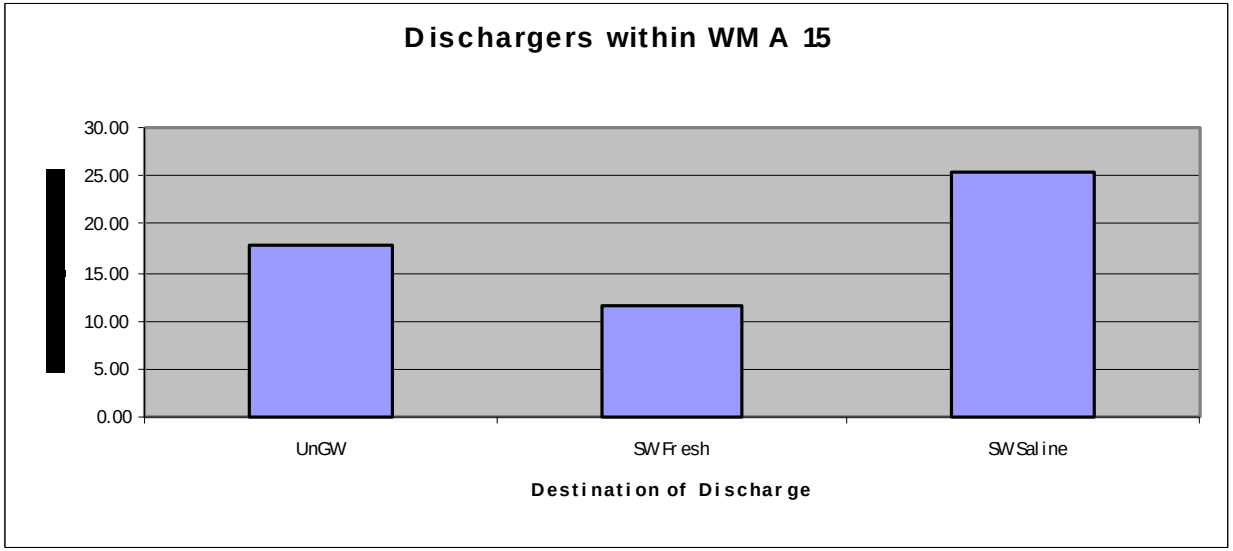
Table A.15.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 15. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.15.3.

Table A.15.1

Purveyor	Reeds Bay / Absecon Bay & tribs	Absecon Creek	Great Egg Harbor River (above Hospitality Branch)	Great Egg Harbor River (Lake Lenape to Hospitality Branch)	Great Egg Harbor River (below Lake Lenape)	Patcong Creek/Great Egg Harbor Bay	Tuckahoe River	Atlantic Coast (Absecon to Great Egg)	Atlantic Coast (Great Egg to 34th St)
Aqua NJ Inc. - Blackwood–			C/U						
Atlantic City MUA		C/S/U							
Berlin Water Department			C/U						
Brigantine Water Department	C								
Buena Borough MUA				C					
Hamilton Twp. MUA					C/U				
Hammonton Water Department			U						
Longport Water Department						C			
Margate City Water Department						C		C	
Monroe Twp. MUA			U	U					
NJ American Water Company Ocean City System						C	C		C
NJ American Water Company – Atlantic Division		C/U				C/U			
Pine Hill Borough MUA			C/U						
Ventnor City Water & Sewer Utility						C			
Winslow Twp. DMU			U						
Woodbine MUA							U		

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.15.3. 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses*

3) Population and Demand Projections

Table A.15.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 15:

Table A.15.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040302010	Reeds Bay / Absecon Bay & tribs	49,426	50,314	51,201	52,060	52,918	53,909
02040302020	Absecon Creek	17,972	19,245	20,518	22,004	23,493	25,311
02040302030	Great Egg Harbor River	50,452	52,743	55,195	57,939	60,992	63,420
02040302040	Great Egg Harbor River	34,801	36,802	39,419	42,252	45,285	48,521
02040302050	Great Egg Harbor River	26,924	29,979	33,033	36,695	40,358	44,888
02040302060	Patcong Creek/Great Egg Harbor Bay	80,737	84,099	87,458	91,172	94,878	99,257
02040302070	Tuckahoe River	13,970	14,620	15,266	15,930	16,579	17,229
02040302920	Atlantic Coast (Absecon to Great Egg)	6,511	6,585	6,658	6,715	6,774	6,831
02040302930	Atlantic Coast (Great Egg to 34th St)	1,891	1,946	2,001	2,057	2,112	2,166
WMA 15 Total Population		**282,684**	**296,333**	**310,749**	**326,824**	**343,389**	**361,532**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.15.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A15.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040302010	51,201	52,060	0.09	52,918	0.09	53,909	0.10
02040302020	20,518	22,004	0.15	23,493	0.15	25,311	0.18
02040302030	55,195	57,939	0.27	60,992	0.31	63,420	0.24
02040302040	39,419	42,252	0.28	45,285	0.30	48,521	0.32
02040302050	33,033	36,695	0.37	40,358	0.37	44,888	0.45
02040302060	87,458	91,172	0.37	94,878	0.37	99,257	0.44
02040302070	15,266	15,930	0.07	16,579	0.06	17,229	0.07
02040302920	6,658	6,715	0.01	6,774	0.01	6,831	0.01
02040302930	2,001	2,057	0.01	2,112	0.01	2,166	0.01
Totals	**310,749**	**326,824**	**1.62**	**343,389**	**1.67**	**361,532**	**1.82**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.15.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in eight of WMA 15's nine HUC11 watersheds based on three different scenarios -- 1998-2007 demands, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive (D/C) losses at 1998-2007 use and the projected depletive/consumptive losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.15.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040302010	Reeds Bay / Absecon Bay & tribs	0.9	0.9	0.0	1.1	**-0.2**	0.0
02040302020	Absecon Creek	1.4	14.9	**-13.5**	29.8	**-28.4**	**-13.9**
02040302030	Great Egg Harbor River (above Hospitality Branch)	4.5	9.6	**-5.1**	21.0	**-16.5**	**-5.5**
02040302040	Great Egg Harbor River (Lake Lenape to Hospitality Branch)	11.4	17.9	**-6.5**	27.7	**-16.4**	**-6.6**
02040302050	Great Egg Harbor River (below Lake Lenape)	7.9	5.0	2.8	8.3	**-0.5**	2.6
02040302060	Patcong Creek/Great Egg Harbor Bay	2.1	7.6	0.0	11.7	**-9.6**	**-1.1**
02040302070	Tuckahoe River	5.3	3.6	1.6	6.6	**-1.3**	1.6
02040302930	Atlantic Coast (Great Egg to 34th St)	0.0	0.0	0.0	0.0	0.0	0.0

Table A.15.5 identifies the remaining HUC11 watershed that comprises WMA15. This HUC11 watershed is not significantly affected by upstream, inland watersheds. Remaining water available for depletive/consumptive use is calculated the same as for *Table A.15.4*. The large volume of water shown to be available for depletive/consumptive purposes in this HUC11 watershed is misleading because it is associated with wastewater that is discharged (via Atlantic County Utilities Authority) into the Atlantic Ocean. Thus, while this HUC11 watershed appears to be gaining water that could be used for depletive/consumptive uses, this should not be interpreted as additional available fresh water. Nevertheless, these discharges represent a potential resource to be utilized as Reclaimed Water for Beneficial Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource (prior to its discharge to tidal water) represents an ideal opportunity to meet mitigation objectives where highly consumptive, non-potable water uses currently or are projected to cause stress in one or more HUC11 watersheds.

Table A.15.5

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040302920	Atlantic Coast (Absecon to Great Egg)	0.00	-26.2	26.2	-26.5	26.5	26.2

Notes:

1) The significance of "losses" is explained in more detail under Section 6 below.

2) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

5) Water Supply Status (Resource Availability)

Table A.15.6 identifies the total resource availability associated with WMA 15. In addition, the table shows 1998-2007 demands, full allocation and estimated 2020 demands, and the corresponding remaining available water supply in WMA15 under these three scenarios.

Table A.15.6 WMA 15 (Great Egg Harbor) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	33	59	-25	-72
confined groundwater	23	23	0	0
sum:	56	82	-25	-72

WMA 15 2020 Demand and Availability	
current remaining availability	-25 mgd
potable use increase by 2020	6.1 mgd
2020 remaining available water	-31 mgd

WMA 15 Options for Additional Water	
ocean/bay sanitary sewer	25 mgd
potable conservation savings	2.1 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

Stresses triggered by the Low Flow Margin (LFM) methodology in WMA 15 occur within four of the nine HUC11 watersheds in WMA 15 currently and seven of the nine watersheds under the full allocation scenario. The stresses identified in the Reeds Bay/Absecon Bay & Tribs, Absecon Creek and Patcong Creek/Great Egg Harbor Bay HUC11 watersheds are attributable to the volume of wastewater generated in these three HUC11s, which is then treated by the Atlantic County Utilities Authority and discharged to the Atlantic Ocean (depletive loss). In addition, water diverted from the Absecon Creek HUC11 watershed is utilized as a source of supply elsewhere (i.e. "exported" and considered a depletive loss). The transfer of generated wastewater is also the cause of stress in the Great Egg Harbor River (above Hospitality Branch) HUC11 as this wastewater is sent to the Camden County Municipal Utilities Authority.

The Great Egg Harbor River (Lake Lenape to Hospitality Branch) HUC11 is stressed, and it and the Great Egg Harbor River (Above Hospitality Branch) and Tuckahoe River HUC11 watersheds all show projected stress at full allocation based on the consumptive loss associated with agricultural water use. The highly consumptive nature associated with agricultural irrigation, particularly during the summer months, further stresses local streams and the unconfined groundwater system. Therefore, deficits projected at full allocation may be misleading and further analysis is necessary to ensure realistic allocation limits for agricultural operations.

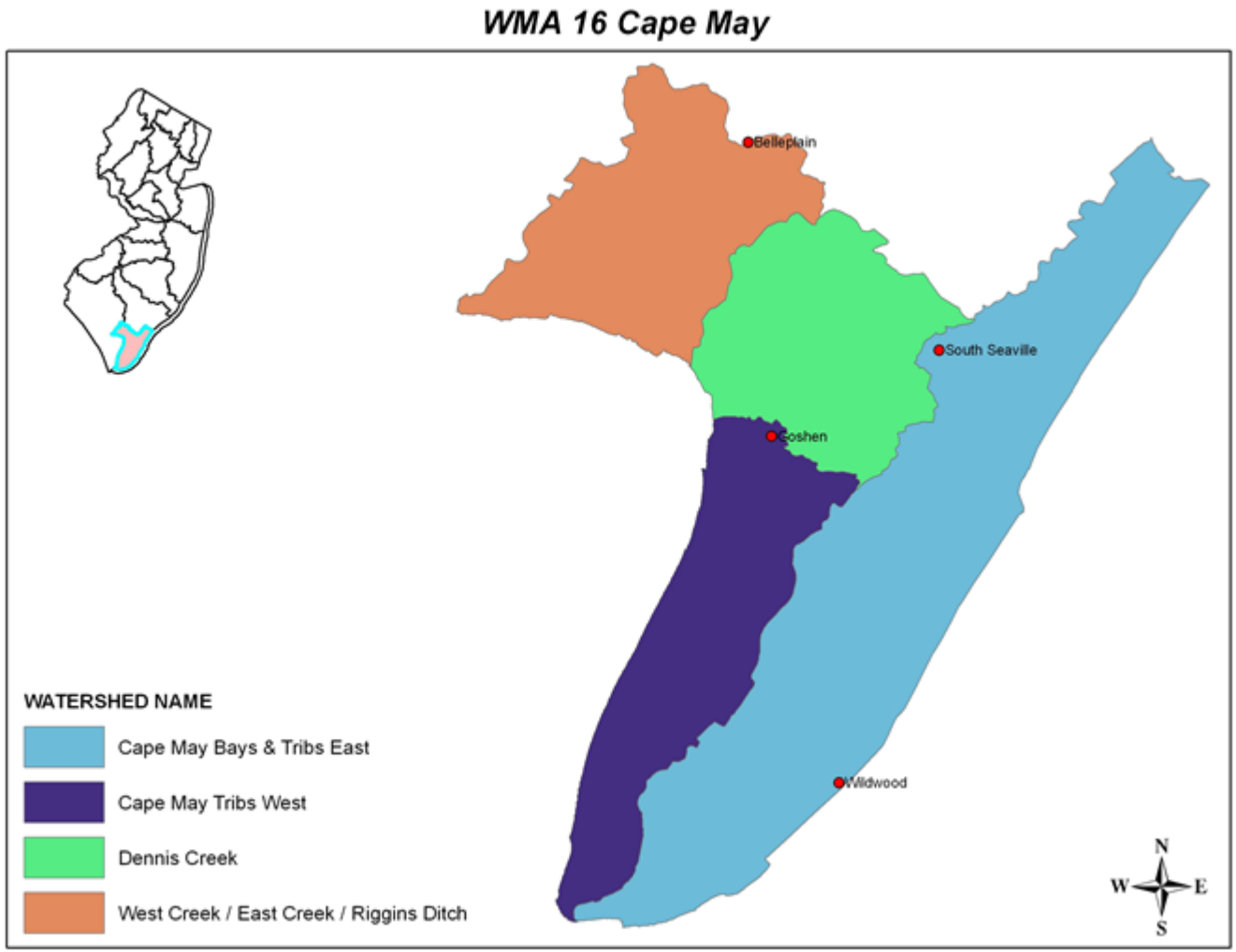
7) Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the Great Egg Harbor River (Lake Lenape to

Hospitality Branch and Above Hospitality Branch) and Tuckahoe River HUC11 watersheds.

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Absecon Creek, Great Egg Harbor River (above Hospitality Branch) and Great Egg Harbor River (Lake Lenape to Hospitality Branch) HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Great Egg Harbor River (below Lake Lenape), Patcong Creek/Great Egg Harbor Bay and Tuckahoe River HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.

Watershed Management Area 16 Cape May



Recommended Initiatives for Watershed Management Area 16: Cape May

1) Description of Planning Area

Watershed Management Area (WMA) 16, which is 391.7 square miles, is located in the extreme southern end of New Jersey's Coastal Plain Province, and is surrounded by the Atlantic Ocean and Delaware Bay. The region consists of a low lying and gently rolling plain that is 54 feet above sea level at its highest point and is largely covered by wet (hydric) soils and wetlands. Large expanses of swamp land (Great Cedar, Timber and Beaver Swamps) occupy the north-central part of the WMA. Most, if not all, streams here terminate by flowing into freshwater swamps in their lower reaches that, in turn, discharge into tidal saltwater bodies and marshes near the shore. WMA 16 includes four HUC11 watersheds (Cape May Tribs West, Cape May Bays & Tribs East, Dennis Creek, and West Creek/East Creek/Riggins Ditch) that drain to either the Atlantic Ocean or Delaware Bay. A fifth HUC11 watershed, the Atlantic Coast (34th Street to Cape May Point) (shown on the map/legend without shading) extends from the shoreline boundary of the contiguous HUC11 (Cape May Bays & Tribs East) out into the Atlantic Ocean.

The county's permanent year-round population is approximately 97,000, with 41 percent of the population residing on the barrier islands that comprise the eastern perimeter of the peninsula. The summertime population rises significantly and is estimated at 750,000 with 65 percent residing on the barrier islands.

The principal water resource issue within WMA 16 is drinking water supply. The area is largely dependent upon groundwater resources that are highly vulnerable to saltwater intrusion from the west, south and east, particularly in the southern portion of the peninsula.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 16 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 16, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 31.83 MGD, of which 29% was diverted from unconfined groundwater, 1% from surface water and 70% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 9.38 MGD
Surface Water = 0.21 MGD
Confined groundwater = 22.25 MGD

Figure A.16.1

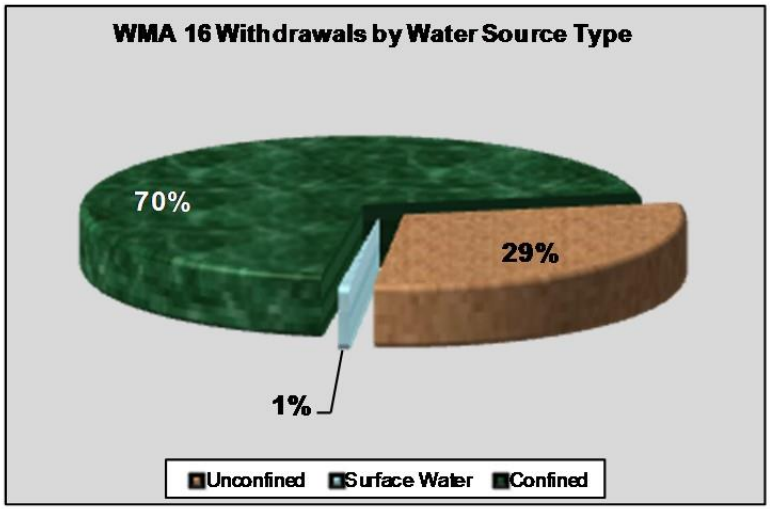
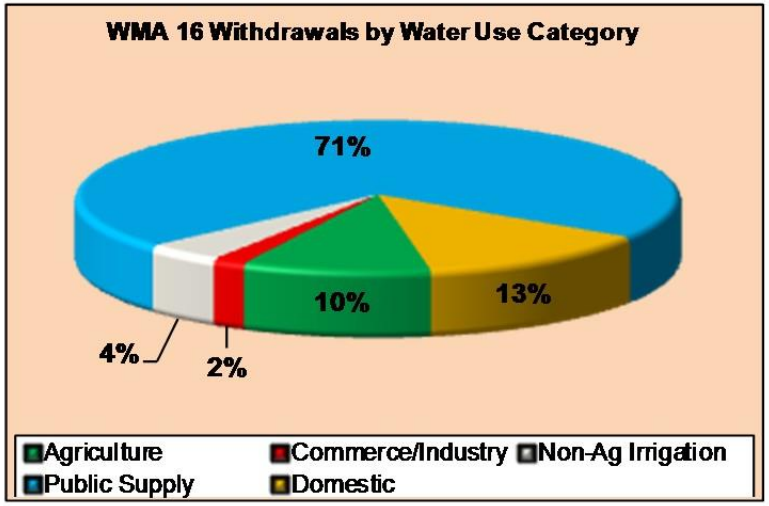


Figure A.16.2



There are five water user types within WMA 16 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 16 are as follows: public supply – 22.66 MGD (97% confined and 3% unconfined groundwater); domestic supply – 4.06 MGD (100% unconfined groundwater); commerce/industry/mining – 0.58 MGD (100% unconfined groundwater); agriculture – 3.20 MGD (99% unconfined groundwater and 1% surface water); and non-agricultural irrigation – 1.34 MGD (70% unconfined groundwater, 17% confined groundwater and 13% surface water). Refer to Figures A.16.1 and A.16.2.

Identification of Public Community Water System's Sources

Table A.16.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 16. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.16.3.

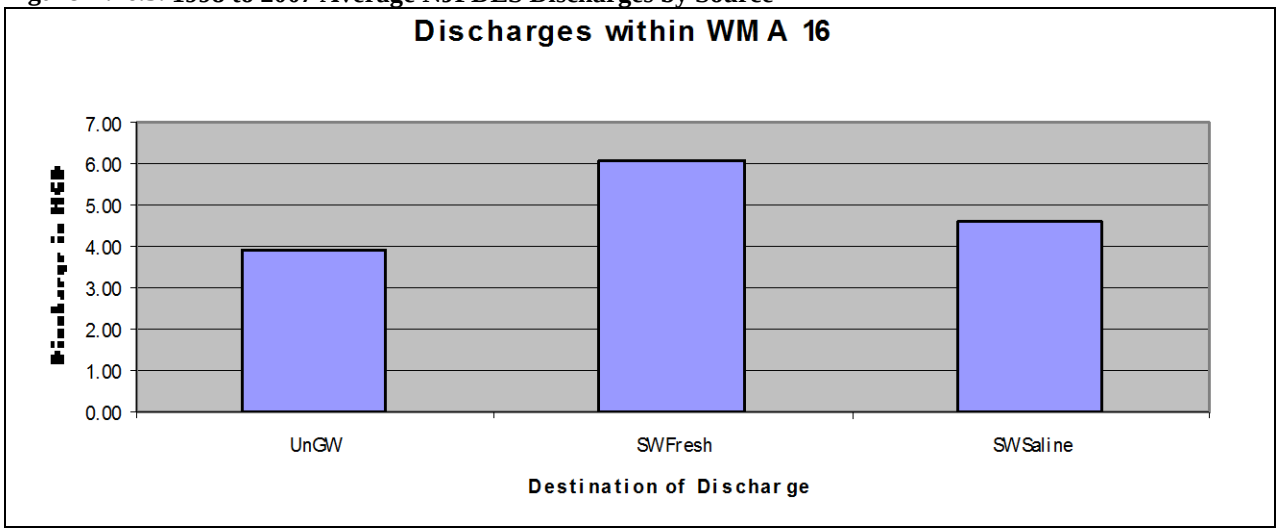
Table A.16.1

Purveyor	West Creek / East Creek / Riggins Ditch	Cape May Tribs West	Cape May Bays & Tribs East	Atlantic Coast (34th St to Cape May Point)
Avalon Water & Sewerage Utilities				C
Cape May Water & Sewer Utilities			C	
Lower Twp. MUA		C	C	
NJ American Water - Ocean City System			C	
NJ American Water - Cape May System			C	
NJ State Prison Bayside	C/U			
Sea Isle City Water Department			C	
Stone Harbor Water Department			C	C
Wildwood City Water Department		C/U	C/U	

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

NJPDES Discharges (1998-2007)

Figure A.16.3. 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.*

3) Population and Demand Projections

Table A.16.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 16:

Table A.16.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040206210	West Creek / East Creek / Riggins Ditch	3,988	4,165	4,338	4,566	4,758	4,947
02040206220	Dennis Creek	6,589	6,909	7,227	7,566	7,905	8,235
02040206230	Cape May Tribs West	18,551	19,400	20,248	21,085	21,921	22,735
02040302080	Cape May Bays & Tribs East	44,655	46,456	48,254	50,038	51,817	53,554
02040302940	Atlantic Coast (34th St to Cape May Pt)	9,351	9,672	9,989	10,306	10,623	10,931
WMA 16 Total Population		**83,134**	**86,602**	**90,056**	**93,561**	**97,024**	**100,402**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table 7.16.3* shows how much additional demand is estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table 7.16.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040206210	4,338	4,566	0.02	4,758	0.02	4,947	0.02
02040206220	7,227	7,566	0.03	7,905	0.03	8,235	0.03
02040206230	20,248	21,085	0.08	21,921	0.08	22,735	0.08
02040302080	48,254	50,038	0.18	51,817	0.18	53,554	0.17
02040302940	9,989	10,306	0.03	10,623	0.03	10,931	0.03
Totals	**90,056**	**93,561**	**0.34**	**97,024**	**0.34**	**100,402**	**0.33**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

*Table A.16.*4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined ground water/unregulated surface water supplies in each of WMA 16's five HUC11 watersheds based on three different scenarios -- 1998-2007 water use, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at1998-2007 use and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.16.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040206210	West Creek / East Creek / Riggins Ditch	1.4	1.4	0.0	2.8	**-1.4**	0.0
02040206220	Dennis Creek	1.1	1.2	0.0	2.9	**-1.8**	0.0
02040206230	Cape May Tribs West	1.0	-2.3	3.3	0.0	1.0	3.3
02040302080	Cape May Bays & Tribs East	2.2	-5.5	7.7	-2.4	4.6	7.7
02040302940	Atlantic Coast (34th St to Cape May Pt)	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

3) The significance of "losses" is explained in more detail under Section 6 below.

4) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The volume of water shown to be available for depletive/consumptive purposes in the Cape May Tribs West and Cape May Bays & Tribs East HUC11 watersheds is slightly misleading as a majority of that quantity consists of wastewater that is discharged to the Atlantic Ocean by the following wastewater treatment facilities: Ocean City**;** Seven Mile Beach-Middle; Wildwood Lower; and Cape May. Thus, while these two HUC11 watersheds appear to be gaining water that could be used for depletive/consumptive uses, this should not be interpreted as additional available fresh water. Nevertheless, these discharges represent a resource to be utilized as Reclaimed Water for Beneficial Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource (prior to its discharge to tidal water) represents an ideal opportunity to meet mitigation

objectives where highly consumptive, non-potable water uses currently or are projected to cause stress in one or more HUC11 watersheds.

5) Water Supply Status (Resource Availability)

Table A.16.5 identifies the total resource availability associated with WMA 16. In addition, the table shows 1998-2007 uses, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 16 based on these three scenarios. _

Table A.16.5 WMA 16 (Cape May) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	6	-1	6	-2.2
confined groundwater	15	15	0	0
sum:	21	14	6	-2.2

WMA 16 2020 Demand and Availability	
current remaining availability	6 mgd
potable use increase by 2020	1.4 mgd
2020 remaining available water	5 mgd

WMA 16 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	5 mgd
potable conservation savings	0.4 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Ground Water/Unregulated Surface Water Sources

The stresses triggered using the Low Flow Margin (LFM) methodology in WMA 16, particularly in the West Creek/East Creek/ Riggins Ditch and Dennis Creek HUC11 watersheds under the full allocation scenario are mainly associated with consumptive agricultural irrigation diversions.

Concern over unsustainable use of groundwater in the Cape May peninsula has a long history (Gill, 1962). Because it is a peninsula and is surrounded by salt water on both sides, and because the aquifers that supply water in Cape May may be exposed beneath Delaware Bay, the progressive pumping of water from the confined Cohansey and Atlantic City 800-foot sand aquifers has lowered water levels and caused salt water intrusion inland, where it threatens the Lower Township well fields and the Wildwood Borough Rio Grande well field to its north.

An intensive study of Cape May County's water supply was completed by the U.S. Geological Survey in 2009. This study, mandated by P.L. 2001, c.165, and commonly referred to as the "Cape May Study", evaluated the present and future water supply needs of the County, while minimizing adverse groundwater or ecological impacts on the area. Study findings indicate that the confined Cohansey aquifer is not a sustainable water source, as the model results show that some of the Lower Township MUA and Wildwood Water Utility wells will be adversely affected by salt water intrusion (i.e. the 250mg/l isochlor) by 2050.

The Cape May Study report identified nine alternative scenarios that may help Cape May County realize a sustainable water supply. The range of scenarios includes the use of existing wells, the addition and optimal location of new wells, conjunctive use of aquifers, the creation of a hydraulic barrier to salt water through the injection of highly treated water, and desalinization.

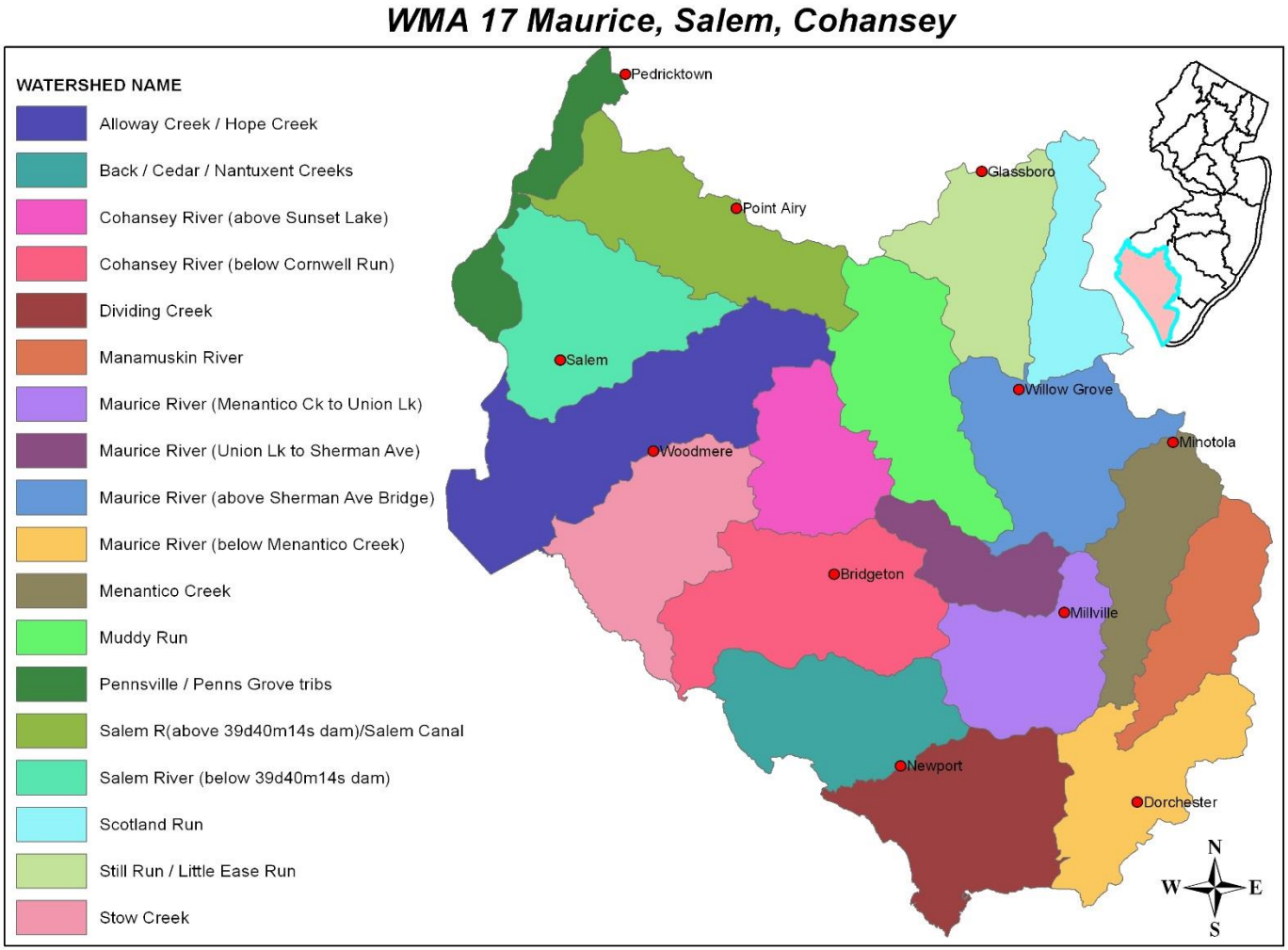
Following release of the USGS study report, the Department conducted public meetings with County and local officials and water suppliers, as well as other interested parties, beginning in May 2010 and as recently as July 2012. During these meetings, the USGS findings were presented, future water supply option scenarios discussed, and feedback on the report received. The Department will continue to work with Cape May municipal and County officials regarding the report's short and long-term recommendations to ensure a sustainable water supply for the foreseeable future (the next 100 years). The Department will work

cooperatively with the County to facilitate implementation of these steps.

7) Management Options

- The Department will continue to coordinate with Cape May County officials to facilitate selected short- and long-term water supply options aimed at ensuring a sustainable water supply.
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for facilities located in the West Creek/East Creek/Riggins Ditch and Dennis Creek HUC11 watersheds.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).

Watershed Management Area 17 Maurice, Salem, Cohansey



Recommended Initiatives for Watershed Management Area 17: Maurice, Salem, Cohansey

1) Description of Planning Area

Watershed Management Area (WMA) 17, the State's largest, is located in the Coastal Plain Province in the extreme southwestern corner of New Jersey, adjacent to both the Delaware River and Delaware Bay, and encompasses approximately 1,224 square miles. WMA 17 includes portions of Atlantic, Cumberland, Gloucester and Salem Counties. The Cohansey, Maurice and Salem Rivers are the main surface water components in WMA 17. Nineteen (19) HUC11 watersheds comprise WMA 17. One of these HUC11 watersheds (Delaware Bay (Cape May Point to Fishing Creek)) (shown on the map/legend without shading) extends from the shoreline boundary of several contiguous HUC11s out into Delaware Bay.

The Cohansey River is nearly 30 miles long, draining 105 square miles of eastern Salem County to the Delaware Bay. It is an area of very low physiographic relief, which results in numerous small, meandering tributaries. Sunset Lake and Mary Elmer Lake are among the 20 significant impoundments in this portion of the WMA. Although much of the land surface remains forested, the main land use in is agriculture.

The Maurice River has a drainage area of 386 square miles and meanders south for 50 miles through Cumberland County to the Delaware Bay. Primary tributaries to this river are Scotland Run, Manantico Creek, Muskee Creek, Muddy Run and the Manumuskin River. There are also about 20 major lakes in this area, the largest of which is Union Lake. The principal land use here is also agriculture.

The Salem River drains an area of 114 square miles and flows 32 miles from Upper Pittsgrove Township westward to Deepwater, then south to the Delaware River. Much of the lower portions of the river are tidal. The major tributaries of the Salem River include the Mannington Creek, Game Creek, Majors Run and Fenwick Creek. Land use in this drainage basis is about 40% cropland, with the remainder comprised of woodland/pasture, tidal/freshwater marsh, and urban.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 17 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 17, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 303.52 MGD of which 48% diverted from unconfined groundwater, 47% surface water and 5% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 146.53 MGD
Surface Water = 142.98 MGD
Confined groundwater = 14.01 MGD

Figure A.17.1

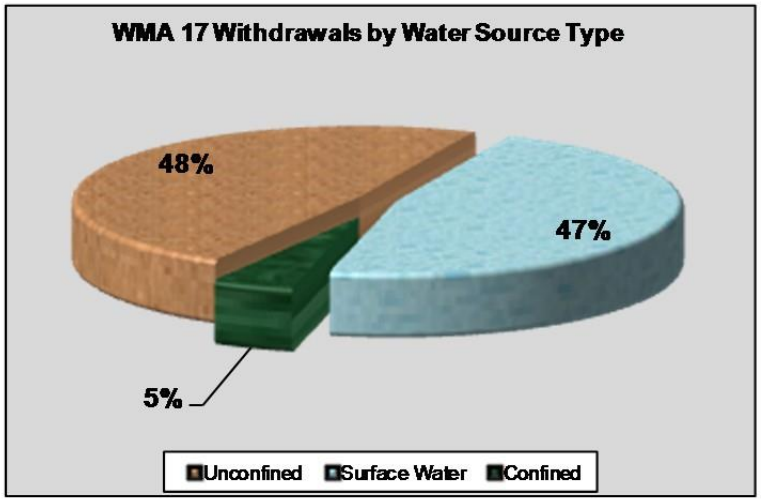
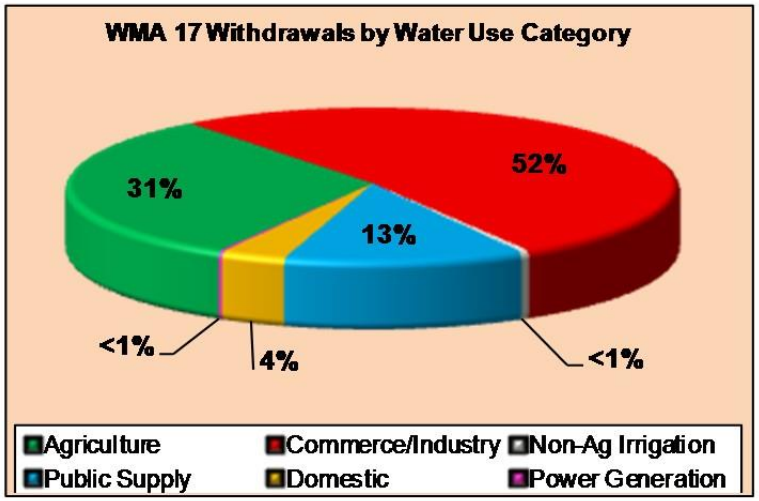


Figure A.17.2



There are five water user types within WMA 17 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 17 are as follows: public supply – 38.40 (77% unconfined groundwater, 20% confined groundwater and 3% surface water); domestic supply – 10.57 MGD (100% unconfined groundwater); commerce/industry/mining – 157.66 MGD (82% surface water, 16% unconfined groundwater and 2% confined groundwater); agriculture – 94.84 MGD (84% unconfined groundwater, 14% surface water and 2% confined groundwater); and non-agricultural irrigation – 1.40 MGD (63% unconfined groundwater, 21% confined groundwater and 16% surface water).

There are a limited number of aquifers in this region that are not subject to saltwater intrusion. Using the confined systems in this area influences the movement of the 250 mg/l per chloride line. Subsequently, the use of confined aquifers is not the main source of supply in this region. The principal confined aquifers that are considered a reliable source of water in WMA 17, are the Rio-Grande water-bearing zone, Piney Point, and Wenonah-Mount-Laurel. Refer to Figures A.17.1 and A.17.2.

Identification of Public Community Water System's Sources

Table A.17.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 17. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.17.3.

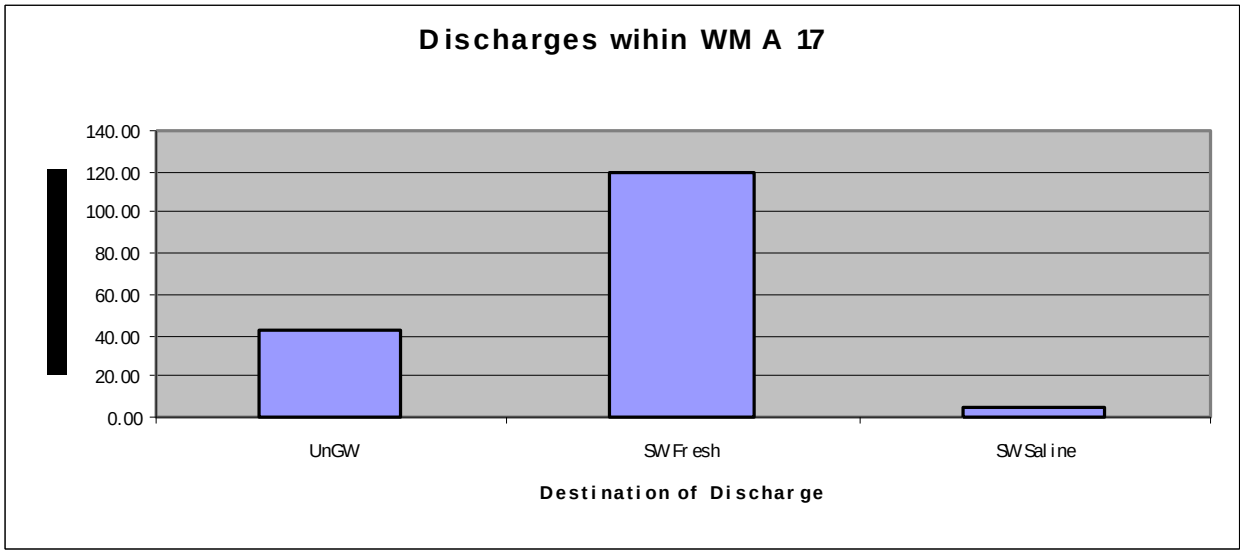
Table A.17.1

Purveyor	Pennsville / Penns Grove tribs	Salem R(above 39d40m14s dam) / Salem Canal	Salem River (below 39d40m14s dam)	Alloway Creek / Hope Creek	Cohansey River (above Sunset Lake)	Cohansey River (below Cornwell Run)	Still Run / Little Ease Run	Scotland Run	Maurice River (above Sherman Ave Bridge)	Muddy Run	Maurice River (Union Lk to Sherman Ave)	Maurice River (Menantico Ck to Union Lk)	Menantico Creek
Bridgeton City Water Department						U							
Clayton Water Department							C/U						
Colonial Estates								U					
Elmer Boro Water Department										C			
Fairton Federal Correctional						U							
Fairview Manor MHP													U
Glassboro Water Department							C						
Millville Water Department											U	U	
Monroe Twp. MUA								U					
Newfield Water Department									U				
NJ American Water – Penns Grove	C/U	U											
Pennsville Twp. Water Department	U		C/U										
Salem Water Department			C	S									
Seabrook Water Corporation					U								
Upper Deerfield Twp. Water Department					U								
Vineland Water & Sewer Utility									U				U
Washington Twp. MUA								C/U					
Woodstown Water Department		C											

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

NJPDES Discharges (1998-2007)

Figure A.17.3. 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.*

3) Population and Demand Projections

Table A.17.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11s located in WMA 17:

Table A.17.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040204910	Delaware Bay (Cape May Pt to Fishing Creek)	0	0	0	0	0	0
02040206020	Pennsville / Penns Grove tribs	14,247	14,223	14,119	13,932	13,810	13,776
02040206030	Salem R(above 39d40m14s dam)/Salem Canal	12,561	12,606	12,798	13,150	13,381	13,443
02040206040	Salem River (below 39d40m14s dam)	14,908	14,883	14,773	14,574	14,445	14,411
02040206060	Alloway Creek / Hope Creek	5,736	5,759	5,858	6,042	6,161	6,195
02040206070	Stow Creek	3,502	3,586	3,699	3,894	4,032	4,134
02040206080	Cohansey River (above Sunset Lake)	6,896	7,139	7,377	7,776	8,072	8,362
02040206090	Cohansey River (below Cornwell Run)	31,223	32,355	33,457	35,301	36,666	38,024
02040206100	Back / Cedar / Nantuxent Creeks	4,831	5,016	5,194	5,496	5,719	5,940
02040206110	Dividing Creek	3,679	3,833	3,983	4,233	4,419	4,603
02040206120	Still Run / Little Ease Run	23,922	25,420	26,925	28,429	30,414	32,342
02040206130	Scotland Run	14,347	14,948	15,871	16,796	17,788	18,596
02040206140	Maurice River (above Sherman Ave Bridge)	31,672	32,793	34,006	35,977	37,453	38,792
02040206150	Muddy Run	10,458	10,629	11,003	11,669	12,119	12,336
02040206160	Maurice River (Union Lake to Sherman Ave)	11,003	11,455	11,893	12,627	13,169	13,710
02040206170	Maurice River (Menantico Creek to Union	19,127	19,908	20,667	21,938	22,882	23,818
02040206180	Menantico Creek	25,657	26,663	27,640	29,251	30,451	31,651
02040206190	Manamuskin River	11,038	11,483	11,916	12,626	13,157	13,687
02040206200	Maurice River (below Menantico Creek)	4,703	4,894	5,078	5,389	5,618	5,846
WMA 17 Total Population		**249,510**	**257,593**	**266,257**	**279,100**	**289,756**	**299,666**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.17.3* shows how much additional demand is estimated for each of the HUC11s in 2015, 2020 and 2025.

Table A.17.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040204910	0	0	0.00	0	0.00	0	0.00
02040206020	14,119	13,932	-0.02	13,810	-0.01	13,776	0.00
02040206030	12,798	13,150	0.04	13,381	0.02	13,443	0.01
02040206040	14,773	14,574	-0.02	14,445	-0.01	14,411	0.00
02040206060	5,858	6,042	0.02	6,161	0.01	6,195	0.00
02040206070	3,699	3,894	0.02	4,032	0.01	4,134	0.01
02040206080	7,377	7,776	0.04	8,072	0.03	8,362	0.03
02040206090	33,457	35,301	0.18	36,666	0.14	38,024	0.14
02040206100	5,194	5,496	0.03	5,719	0.02	5,940	0.02
02040206110	3,983	4,233	0.03	4,419	0.02	4,603	0.02
02040206120	26,925	28,429	0.15	30,414	0.20	32,342	0.19
02040206130	15,871	16,796	0.09	17,788	0.10	18,596	0.08
02040206140	34,006	35,977	0.20	37,453	0.15	38,792	0.13
02040206150	11,003	11,669	0.07	12,119	0.05	12,336	0.02
02040206160	11,893	12,627	0.07	13,169	0.05	13,710	0.05
02040206170	20,667	21,938	0.13	22,882	0.09	23,818	0.09
02040206180	27,640	29,251	0.16	30,451	0.12	31,651	0.12
02040206190	11,916	12,626	0.07	13,157	0.05	13,687	0.05
02040206200	5,078	5,389	0.03	5,618	0.02	5,846	0.02
Totals	**266,257**	**279,100**	**1.29**	**289,756**	**1.06**	**299,666**	**0.98**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.17.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the nineteen HUC11 watersheds within WMA 17 under three different scenarios -- 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from the 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.17.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040204910	Delaware Bay (Cape May Pt to Fishing Creek)	0.0	0.0	0.0	0.0	0.0	0.0
02040206020	Pennsville / Penns Grove tribs	0.7	-2.1	2.9	-6.2	7.0	2.8
02040206030	Salem R(above 39d40m14s dam)/Salem Canal	1.9	6.7	**-4.8**	19.8	**-17.9**	**-4.8**
02040206040	Salem River (below 39d40m14s dam)	2.4	2.6	**-0.2**	12.3	**-9.8**	**-0.2**
02040206060	Alloway Creek / Hope Creek	4.2	2.3	1.9	6.1	**-1.9**	1.9
02040206070	Stow Creek	3.9	1.8	2.1	13.5	**-9.6**	2.1
02040206080	Cohansey River (above Sunset Lake)	1.8	18.9	**-17.1**	57.8	**-56.0**	**-17.2**
02040206090	Cohansey River (below Cornwell Run)	4.0	8.1	**-4.1**	35.8	**-31.8**	**-4.3**
02040206100	Back / Cedar / Nantuxent Creeks	1.7	3.9	**-2.2**	23.6	**-21.8**	**-2.2**
02040206110	Dividing Creek	1.6	14.5	**-12.9**	29.8	**-28.3**	**-12.9**
02040206120	Still Run / Little Ease Run	2.3	4.5	**-2.2**	12.9	**-10.6**	**-2.3**
02040206130	Scotland Run	1.8	3.7	**-1.9**	5.5	**-3.6**	**-2.2**
02040206140	Maurice River (above Sherman Ave Bridge)	6.8	15.1	**-8.3**	27.6	**-20.9**	**-9.0**
02040206150	Muddy Run	2.7	14.6	**-11.9**	39.5	**-36.9**	**-11.9**
02040206160	Maurice River (Union Lk to Sherman Ave)	1.2	3.6	**-2.4**	7.4	**-6.1**	**-2.5**
02040206170	Maurice River (Menantico Ck to Union Lk)	1.7	2.9	**-1.2**	7.9	**-6.2**	**-1.4**
02040206180	Menantico Creek	3.8	10.9	**-7.1**	25.0	**-21.3**	**-7.2**
02040206190	Manamuskin River	1.8	2.7	**-0.9**	5.7	**-3.8**	**-0.9**
02040206200	Maurice River (below Menantico Creek)	2.8	1.4	1.4	4.0	**-1.2**	1.5

Notes:

5) The significance of "losses" is explained in more detail under Section 6 below.

6) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

5) Water Supply Status (Resource Availability)

Table A.17.5 identifies the total resource availability associated with WMA 17. In addition, the table shows what 1998-2007 demands are, what full allocation and estimated 2020 demands would be, and what the corresponding remaining available water supply would be in WMA 17 based on these three scenarios.

Table A.17.5 WMA 17 (Maurice, Salem and Cohansey) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	47	120	-73	-285
confined groundwater	16	13	3	0
sum:	63	133	-70	-285

WMA 17 2020 Demand and Availability	
current remaining availability	-70 mgd
potable use increase by 2020	4.0 mgd
2020 remaining available water	-74 mgd

WMA 17 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	4.0 mgd
potable conservation savings	1.5 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

As shown in *Table A.17.4*, fourteen HUC11 watersheds within WMA17 are shown to be in deficit, while seventeen of the HUC11 watersheds are projected to be stressed under the full allocation scenario. The principal cause of stress within a majority of the HUC11 watersheds in WMA 17 is the consumptive water loss associated with agricultural withdrawals. The effects of stressed conditions are compounded by the coincidental timing of the diversions with natural low-flow conditions during the growing season. The principal causes of stress for the other WMA 17 HUC11 watersheds are as follows: Dividing Creek HUC11 watershed (consumptive use from commerce/industry/mining operations) and Scotland Run (depletive transfer of wastewater via Gloucester County Utilities Authority in the northern portion of the watershed).

The area now known as WMA 17 was previously identified in the 1996 NJSWSP as an area of anticipated stressed. Since that time, substantial data collection and groundwater modeling has since been conducted within this area. A USGS study in the Upper Maurice Basin verified the findings of the 1996 NJSWSP, concluding that agricultural and potable supply withdrawals, particularly from unconfined groundwater sources, were exacerbating low-flow conditions throughout the Upper Maurice sub-watersheds. Furthermore, these models predicted that even more significant base flow reductions would occur in the Upper Maurice Basin if all allocated diversions (agricultural and potable) were utilized. These findings are consistent with the results of the LFM analysis in the Plan. In response, the Department has instituted a moratorium on the issuance of new or increased water allocations from the Cohansey aquifer, particularly within the three upper Maurice River HUC11 watersheds.

7) Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 17.
- Complete Cumberland County Water Supply feasibility study and implement findings/recommendations.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Salem River (above 39d40m14s dam)/Salem Canal, Salem River (below 39d40m14s dam), Cohansey River (above Sunset Lake), Cohansey River (below Cornwell Run), Back/Cedar/Nantuxent Creeks, Dividing Creek, Still Run/Little Ease Run, Scotland Run, Maurice River (above Sherman Avenue Bridge), Muddy Run, Maurice River (Union Lake to Sherman

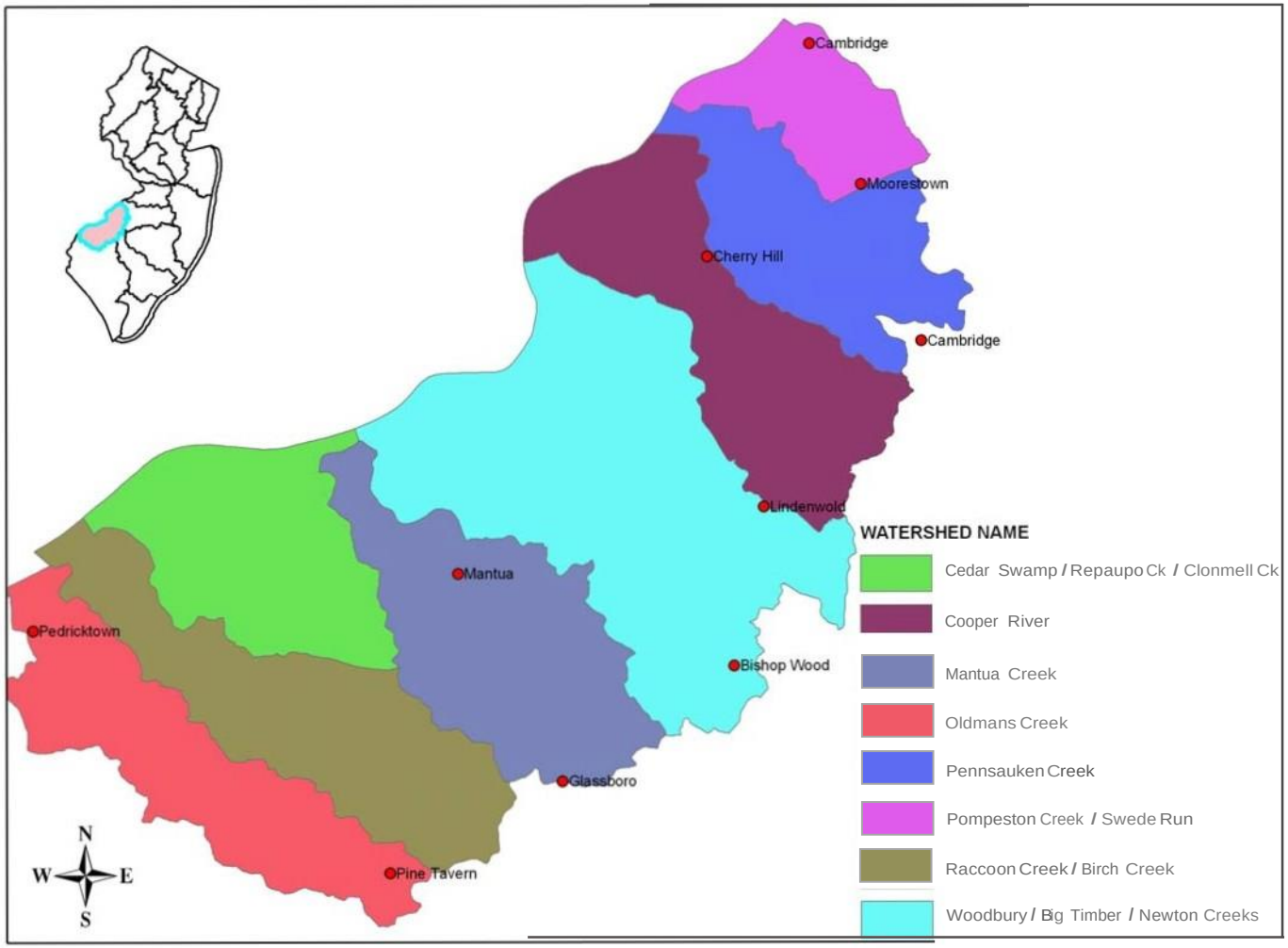
Avenue), Maurice River (Menantico Creek to Union Lake), Menantico Creek and Manamuskin River HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.

- If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
- Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.

- DEP will continue to monitor the Alloway Creek/Hope Creek, Stow Creek and Maurice River (below Menantico Creek) HUC11 watersheds as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
- For proposed new or expanded water allocations (non-residential water users ≥100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 17.

Watershed Management Area 18 Lower Delaware

WMA 18 Lower Delaware



Recommended Initiatives for Watershed Management Area 18: Lower Delaware

1) Description of Planning Area

Watershed Management Area (WMA) 18 is located in the Coastal Plain Province of New Jersey, bordering the Delaware River, encompasses approximately 377 square miles, and includes 68 municipalities located in portions of Gloucester, Camden and Burlington Counties. WMA 18 includes eight (8) HUC11 watersheds as depicted in the map above. Major streams within WMA 18 include the Cooper River, the Big Timber, Mantua, Newton, Oldmans, Pennsauken, Pompeston, Raccoon, Repaupo and Woodbury Creeks, and Baldwin Run, Swede Run and Maple Swamp.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 18 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 18, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 675.30 MGD, of which 6% was diverted from unconfined groundwater, 78% from surface water and 16% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 37.45 MGD
Surface Water = 8.20 MGD
Regulated Surface Water = 524 MGD[12]
Confined groundwater = 105.65 MGD

[12] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined groundwater withdrawals that are in close proximity to and get most if not all of their water from regulated surface water

Figure A.18.1

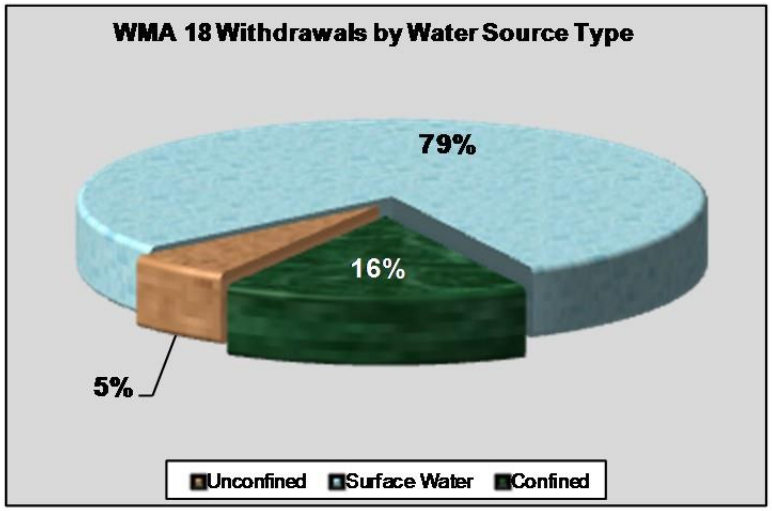
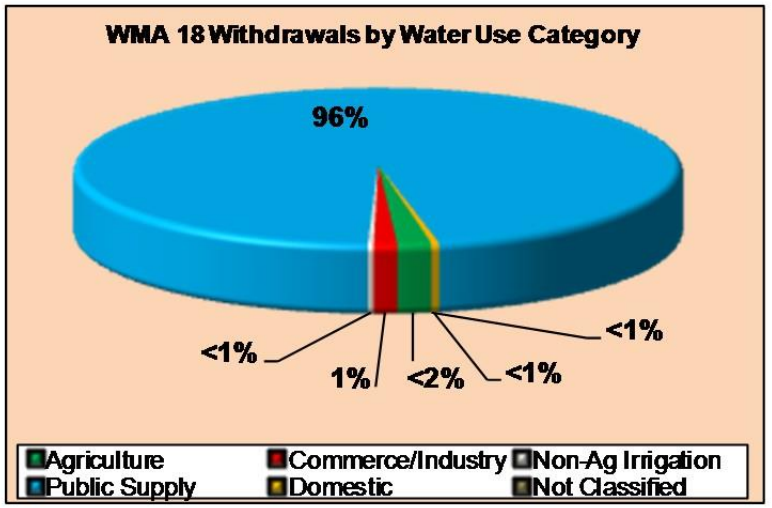


Figure A.18.2



In WMA 18 there are six types of water users (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation, domestic supply, and unclassified usage). Withdrawals by water use category in WMA 18 are as follows: public supply 649.56 MGD (81% surface water, 15% confined groundwater and 4% unconfined groundwater); domestic supply – 2.84 MGD (100% unconfined groundwater); commerce/industry/mining – 8.32 MGD (64% confined groundwater, 20% unconfined groundwater and 16% surface water); agriculture – 12.01 MGD (54% surface water, 40% unconfined groundwater and 6% confined groundwater); non-agricultural irrigation – 2.16 MGD (59% confined groundwater, 28% unconfined groundwater and 13% surface water); and unclassified usage - 0.07 MGD (100% confined groundwater). Refer to Figures A.18.1. and A.18.2.

Diversions from confined groundwater supplies are the main withdrawal in WMA 18. The confined aquifer withdrawals support the potable, agricultural and commercial/industry/mining sectors of the region. The predominantly used aquifers within WMA 18 are the Vincentown, Wenonah-Mount-Laurel, Englishtown, Upper, Middle and Lower PRM aquifers.

A significant portion of this WMA lies within the area designated by the Department as Critical Water Supply Area (Area of Critical Water Supply Concern) No.2 in 1993 (see Chapter 4 for more discussion on this topic). The Critical Area designation was based on excessive withdrawals from confined aquifers in this region and the resulting threat of saltwater intrusion from the Delaware River. As a result, the Department established a policy aimed at stabilizing aquifer water levels through reductions in pumpage from the Potomac-Raritan-Magothy (PRM) aquifer system, the most prolific source of water

in the region, and by prohibiting future annual increases in use from the PRM.

Identification of Public Community Water System's Sources
Table A.18.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 18. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.18.3.

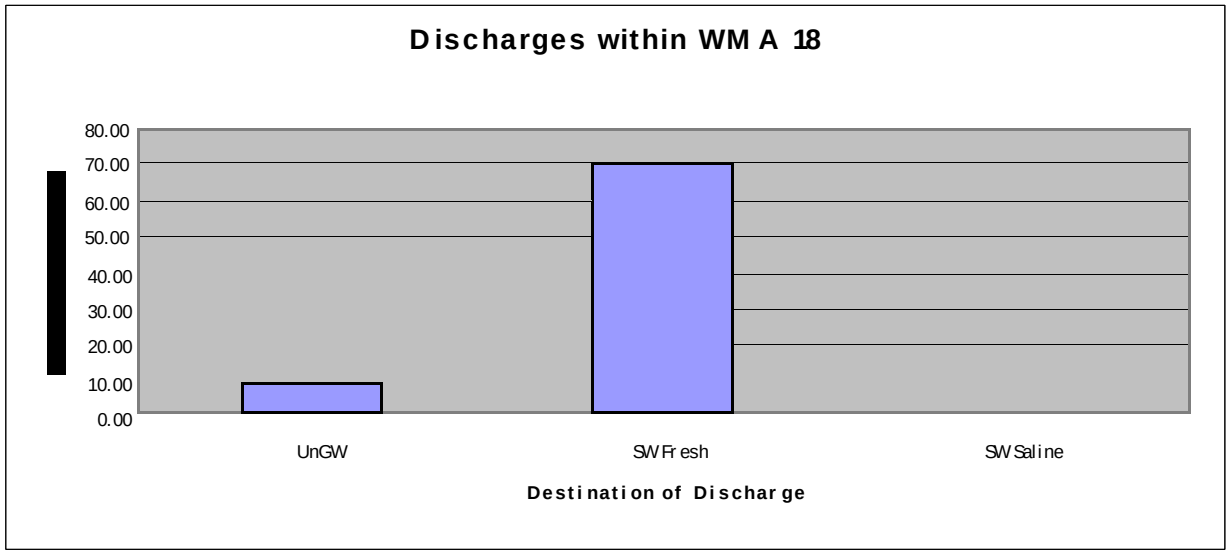
Table A.18.1

Purveyor	Pompeston Creek / Swede Run	Pennsauken Creek	Cooper River	Woodbury / Big Timber / Newton Creeks	Mantua Creek	Cedar Swamp / Repaupo Ck / Clonmell Ck	Raccoon Creek / Birch Creek	Oldmans Creek
Aqua New Jersey - Woolwich								C
Aqua New Jersey INC. - Blackwood				C/U				
Bellmawr Water Department				C				
Brooklawn Water Department				U				
Camden City Water Department		U	C/U	C/U				
Clementon Water Department				C				
Collingswood Water Department			C/U	C/S				
Deptford Twp. MUA				C	C			
East Greenwich Twp. Water					C			
Evesham MUA			C					
Glassboro Water Department					C			
Gloucester City Water Department				C/U				
Greenwich Twp. Water Department						U		
Haddon Twp. Water Department				C				
Haddonfield Water Department			C					
Mantua Two. MUA					C			
Maple Shade Water Department		C						
Merchantville Pennsauken		C/U	C/U					
Moorestown Water Department		C						
Mt. Laurel Twp. MUA		C						

Purveyor	Pompeston Creek / Swede Run	Pennsauken Creek	Cooper River	Woodbury / Big Timber / Newton Creeks	Mantua Creek	Cedar Swamp / Repaupo Ck / Clonmell Ck	Raccoon Creek / Birch Creek	Oldmans Creek
National Park Water Department				C/U				
NJ American Water Company - Logan							C/U	
NJ American Water - Bridgeport							U	
NJ American Water – Mullica Hill							C	
NJ American Water Company Western	S/U	C/U						
Paulsboro Water Department					U			
Pine Hill Borough MUA				C				
Pitman Water Department					C			
Swedesboro Water Department							C	
Washington Township MUA				C	C/U			
Wenonah Water Department					C			
West Deptford Twp. Water Department				C/U	C			
Westville Water Department				U				
Woodbury City Water Department				C	C			
Woodbury Heights Water Utility				C				

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.18.3. 1998 to 2007 Average NJPDES Discharges by Source



Note: *Discharges to surface water-saline receiving waters are considered to be Depletive Water Losses.*

3) Population and Demand Projections

Table A.18.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 18:

Table A.18.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040202090	Pompeston Creek / Swede Run	36,953	39,355	39,474	39,933	40,855	41,382
02040202100	Pennsauken Creek	87,152	88,994	88,760	89,162	90,451	91,218
02040202110	Cooper River	182,609	181,656	180,424	179,367	179,228	177,352
02040202120	Woodbury / Big Timber / Newton Creeks	296,714	299,003	300,628	300,366	300,934	300,383
02040202130	Mantua Creek	75,624	78,292	81,113	83,863	87,031	89,181
02040202140	Cedar Swamp / Repaupo Creek / Clonmell Creek	14,838	15,341	16,069	16,879	17,674	18,356
02040202150	Raccoon Creek / Birch Creek	16,915	18,903	21,258	23,854	26,513	30,568
02040202160	Oldmans Creek	5,997	6,869	7,888	9,361	10,644	11,870
WMA 18 Total Population		**716,802**	**728,413**	**735,614**	**742,785**	**753,330**	**760,310**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.18.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table A.18.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040202090	39,474	39,933	0.05	40,855	0.09	41,382	0.05
02040202100	88,760	89,162	0.04	90,451	0.13	91,218	0.08
02040202110	180,424	179,367	-0.11	179,228	-0.01	177,352	-0.19
02040202120	300,628	300,366	-0.03	300,934	0.06	300,383	-0.06
02040202130	81,113	83,863	0.28	87,031	0.32	89,181	0.22
02040202140	16,069	16,879	0.08	17,674	0.08	18,356	0.07
02040202150	21,258	23,854	0.26	26,513	0.27	30,568	0.41
02040202160	7,888	9,361	0.15	10,644	0.13	11,870	0.12
Totals	**735,614**	**742,785**	**0.72**	**753,330**	**1.06**	**760,310**	**0.70**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.18.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the eight HUC11 watersheds within WMA 18 under three different scenarios -- 1998-2007 water use, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 use and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.18.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040202090	Pompeston Creek / Swede Run	0.6	0.6	0.0	-1.1	1.7	0.0
02040202100	Pennsauken Creek	1.4	4.4	**-3.0**	2.5	**-1.2**	**-3.0**
02040202110	Cooper River	2.2	15.5	**-13.3**	13.5	**-11.3**	**-13.3**
02040202120	Woodbury / Big Timber / Newton Creeks	6.8	-56.0	62.8	-54.8	61.5	62.7
02040202130	Mantua Creek	3.7	3.8	**-0.1**	15.6	**-11.9**	**-0.1**
02040202140	Cedar Swamp / Repaupo Creek / Clonmell Creek	2.9	3.3	**-0.4**	9.1	**-6.2**	**-0.4**
02040202150	Raccoon Creek / Birch Creek	2.8	2.9	**-0.1**	19.0	**-16.2**	**-0.2**
02040202160	Oldmans Creek	2.3	5.2	**-2.9**	21.2	**-18.8**	**-2.9**

Notes:

7) The significance of "losses" is explained in more detail under Section 6 below.

8) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The large volume of water shown to be available for depletive/consumptive purposes in the Woodbury/Big Timber/Newton Creeks HUC11 watershed is due to the location of the Camden County Municipal Utilities Authority (CCMUA) and its subsequent discharge of treated wastewater to the Delaware River. CCMUA is a regional sewerage entity; therefore, the wastewater for this treatment facility is generated and exported from many surrounding HUC11s, particularly the Cooper River HUC11 watershed. Nevertheless, CCMUA represents an opportunity for its treated wastewater to be utilized as Reclaimed Water for Beneficial Reuse for all applicable existing and proposed consumptive water uses. Similarly, this water resource represents an ideal opportunity to meet mitigation objectives where highly consumptive, non-potable water uses currently or are projected to cause stress in one or more HUC11 watersheds.

5) Water Supply Status (Resource Availability)

Table A.18.5 identifies the total resource availability associated with WMA 18. In addition, the table shows the 1998-2007 demands, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 18 under three scenarios.

Table A.18.5 WMA 18 (Lower Delaware) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	23	-20	43	-2.4
confined groundwater	138	103	35	0
sum:	161	83	78	-2.4

WMA 18 2020 Demand and Availability	
current remaining availability	78 mgd
potable use increase by 2020	3.7 mgd
2020 remaining available water	74 mgd

WMA 18 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	3.0 mgd
unbuilt water supply projects	35 mgd

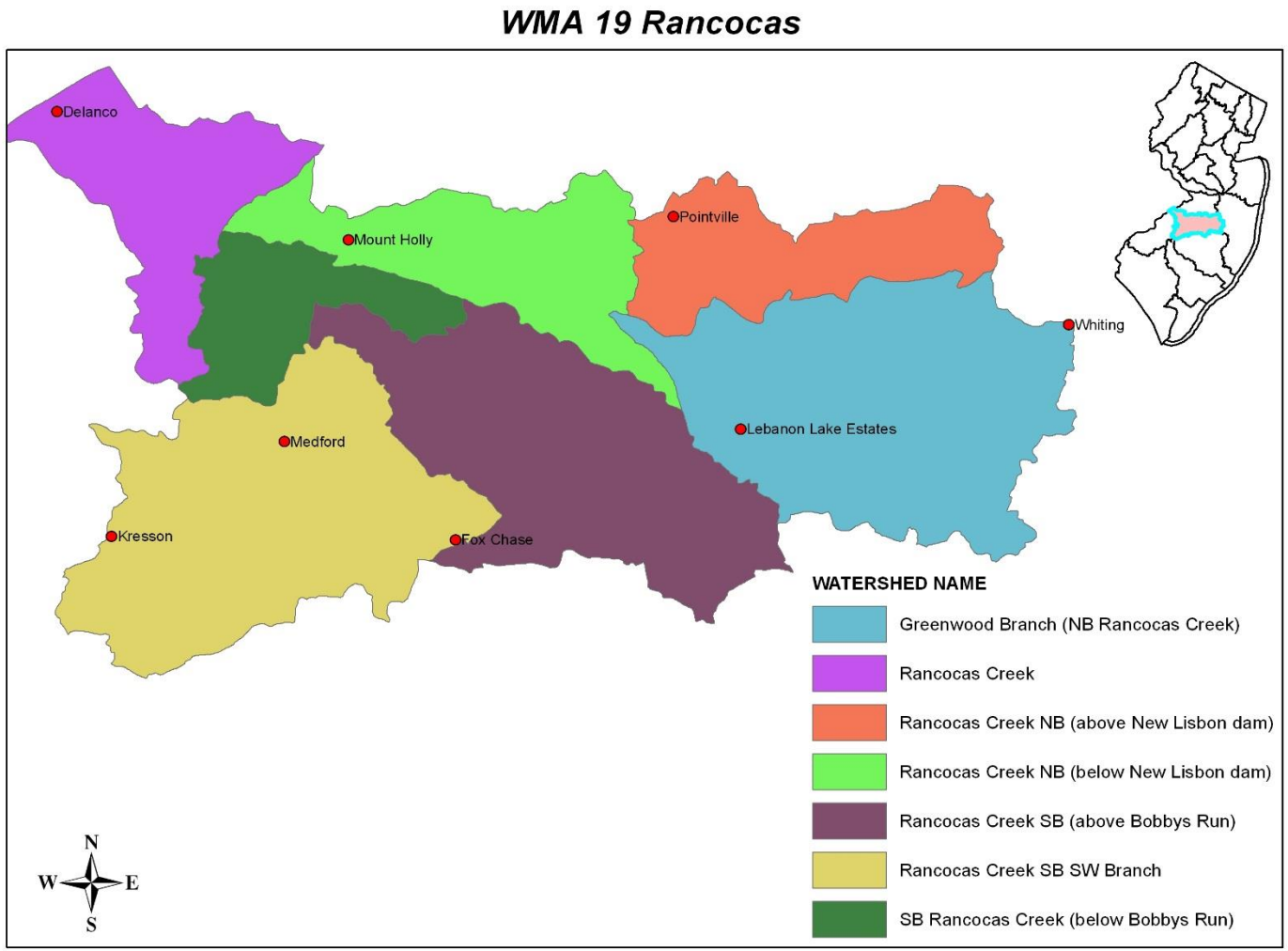
6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

As indicated in *Table A.18.4*, six of the eight HUC11 watersheds in WMA 18 are shown to be stressed when analyzed using the LFM Method. The cause of the stress varies depending on the individual HUC11 watershed as follows: consumptive water losses associated with agricultural irrigation (Cedar Swamp/Repaupo Creek/Clonmell Creek, Raccoon Creek/Birch Creek and Oldmans Creek HUC11 watersheds); leakage from the shallow groundwater system due to pumpage from the confined aquifers (Mantua Creek HUC11 watershed); depletive losses from the exportation of generated wastewater to the CCMUA (Cooper River HUC11 watershed), and the transfer of fresh water from the Pompeston Creek/Swede Run and Pennsauken Creek HUC11 watersheds by the following water suppliers: NJ American Water Company – Western Division, Mount Laurel Township MUA, Moorestown Water Department, Merchantville-Pennsauken Water Commission, Maple Shade Water Department and Camden City Water Department.

7) Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 18, particularly the Cedar Swamp/Repaupo Creek/Clonmell Creek, Raccoon Creek/Birch Creek and Oldmans Creek HUC11s.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Pennsauken Creek, Cooper River, Mantua Creek, Cedar Swamp/Repaupo Creek/Clonmell Creek, Raccoon Creek/Birch Creek and Oldmans Creek HUC11s should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- For proposed new or expanded water allocations (non-residential water users ≥100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 18.

Water Management Area 19 Rancocas



Recommended Initiatives for Watershed Management Area 19: Rancocas

1) Description of Planning Area

Watershed Management Area (WMA) 19 is located in the Coastal Plain Province of New Jersey. The North and South Branches and main stem of the Rancocas Creek, which discharges to the Delaware River, are the significant surface water bodies here. WMA 19 includes seven (7) HUC11 watersheds stretching across 33 municipalities and portions of Burlington, Camden, and Ocean Counties. The WMA encompasses approximately 350 square miles, with a significant portion located within the Pinelands.

The North Branch Rancocas Creek is 31 miles long and is fed by the Greenwood Branch, McDonalds Branch and Mount Misery Brook. The major tributaries to the South Branch Rancocas Creek include the Southwest Branch Rancocas Creek; Stop the Jade Run, Haynes Creek and Friendship Creek.

The main stem flows about 8 miles and drains an area of approximately 49 square miles before emptying into the Delaware River at Delanco and Riverside. Tidal influence occurs for about 15 stream miles extending the entire length of the mainstream to the dam at Mount Holly on the North Branch, Vincentown on the South Branch and Kirby's Mill on the Southwest Branch.

2) Background

Summary of Freshwater Withdrawals
Freshwater withdrawals in WMA 19 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 19, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 53.23 MGD, of which 18% was diverted from unconfined groundwater, 38% from surface water and 44% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 9.47 MGD
Surface Water = 20.24 MGD
Confined groundwater = 23.52 MGD

Figure A.19.1

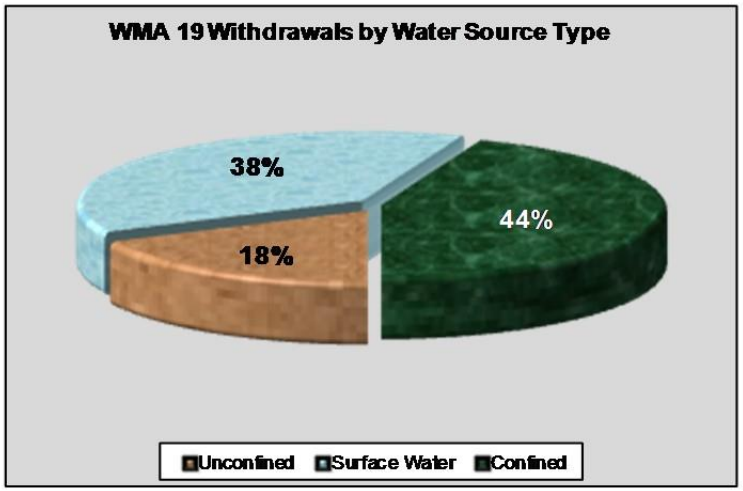
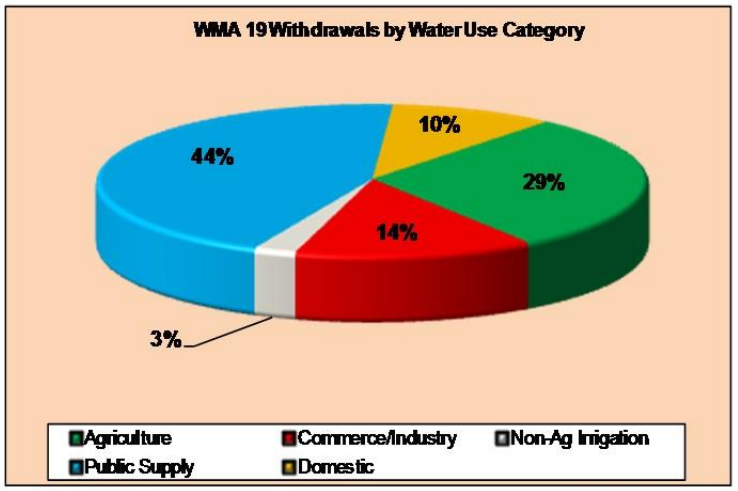


Figure A.19.2



There are five water user types within WMA 19 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 19 are as follows: public supply – 23.53 MGD (87% confined groundwater, 7% unconfined groundwater and 6% surface water); domestic supply – 5.27 MGD (100% unconfined groundwater); commerce/industry/mining – 7.45 MGD (85% surface water, 14% confined groundwater and 1% unconfined groundwater); agriculture – 15.64 MGD (74% surface water, 16% unconfined groundwater and 10% confined groundwater); and non-agricultural irrigation – 1.33 MGD (56% surface water, 41% confined groundwater and 3% unconfined groundwater). Refer to Figures A.19.1. and A.19.2.

The water supply in WMA 19 is not overly reliant upon one hydrologic system, since withdrawals are fairly evenly distributed throughout confined, unconfined and surface water sources, as shown above. The confined aquifers systems that are reliable sources of water within the WMA 19 (located wholly within Critical Area 2) are the Piney Point, Vincentown, Wenonah-Mount-Laurel, Englishtown, Upper, Middle, and Lower PRM aquifer systems.

A significant portion of this WMA lies within the area designated by the Department as Critical Water Supply Area (Area of Critical Water Supply Concern) No.2 in 1993 (see Chapter 3 for more discussion on this topic). The Critical Area designation was based on excessive withdrawals from confined aquifers in this region and the resulting threat of saltwater intrusion from the

Delaware River. As a result, the Department established a policy aimed at stabilizing aquifer water levels through reductions in pumpage from the Potomac-Raritan-Magothy (PRM) aquifer system, the most prolific source of water in the region, and by prohibiting future annual increases in use from the PRM.

Identification of Public Community Water System's Sources

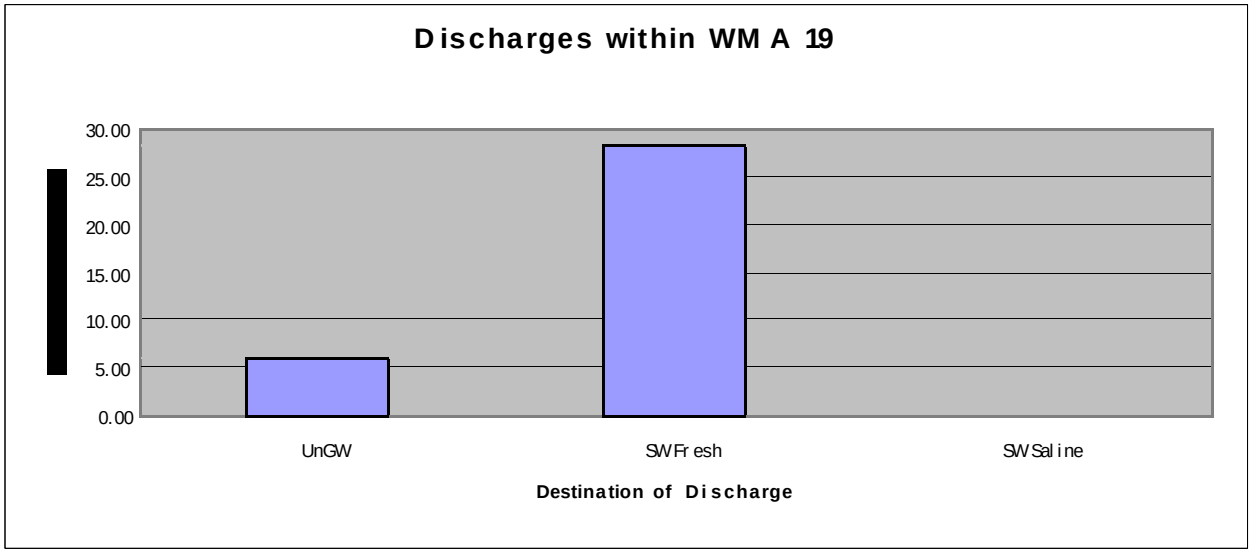
Table A.19.1 lists the purveyors who serve a population equal to or greater than 1,000 people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 19. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.19.3.

Table A.19.1

Purveyor	Rancocas Creek NB (above New Lisbon dam)	Greenwood Branch (NB Rancocas Creek)	Rancocas Creek NB (below New Lisbon dam)	Rancocas Creek SB (above Bobby's Run)	Rancocas Creek SB SW Branch	Rancocas Creek
Berlin Water Department					U	
Cedar Glen Lakes Water Company		U				
Evesham MUA					C	
Medford Twp. Department of Municipalities					C	
Moorestown Water Department						C
New Lisbon Development Center				U		
NJ American Water Company – Mount Holly			C			
NJ American Water Company – Western Division						C/U
Pemberton Borough Water			C			
Pemberton Twp. Water – Lake Valley			C			
Pemberton Twp. Department of Municipalities	C	C				
Pinelands Water Company		C				
U S Army Fort Dix				C		
Willingboro MUA						C

For deficit/surplus information pertaining to individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.19.3. 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.19.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11s located in WMA 19:

Table A.19.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040202020	Rancocas Creek NB (above New Lisbon	12,359	12,664	13,303	13,740	14,271	14,753
02040202030	Greenwood Branch (NB Rancocas Creek)	25,482	27,895	28,594	29,288	30,621	32,044
02040202040	Rancocas Creek NB (below New Lisbon	28,634	30,032	32,776	33,708	34,768	35,682
02040202050	Rancocas Creek SB (above Bobby's Run)	13,868	14,900	15,270	15,736	16,562	17,371
02040202060	Rancocas Creek SB SW Branch	69,410	75,544	77,633	79,966	82,000	84,620
02040202070	SB Rancocas Creek (below Bobby's Run)	18,752	22,348	23,894	25,022	26,161	27,660
02040202080	Rancocas Creek	78,875	81,319	83,229	85,700	88,175	90,364
WMA 19 Total Population		**247,380**	**264,702**	**274,699**	**283,160**	**292,558**	**302,494**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table A.19.3* shows the additional demand estimated for each of the HUC11 watersheds in 2015, 2020 and 2025.

Table 7.19.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040202020	13,303	13,740	0.04	14,271	0.05	14,753	0.05
02040202030	28,594	29,288	0.07	30,621	0.13	32,044	0.14
02040202040	32,776	33,708	0.09	34,768	0.11	35,682	0.09
02040202050	15,270	15,736	0.05	16,562	0.08	17,371	0.08
02040202060	77,633	79,966	0.23	82,000	0.20	84,620	0.26
02040202070	23,894	25,022	0.11	26,161	0.11	27,660	0.15
02040202080	83,229	85,700	0.25	88,175	0.25	90,364	0.22
Totals	**274,699**	**283,160**	**0.84**	**292,558**	**0.93**	**302,494**	**0.99**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

*Table A.19.*4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water supplies in each of the seven HUC11 watersheds within WMA 19 under three different scenarios -- 1998-2007 uses, full allocation, and projected population/water demands for 2020. The values for 1998-2007 uses and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 uses and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.19.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040202020	Rancocas Creek NB (above New Lisbon dam)	2.7	2.8	**-0.1**	4.1	**-1.4**	**-0.1**
02040202030	Greenwood Branch (NB Rancocas Creek)	4.4	2.2	2.2	1.5	2.9	2.2
02040202040	Rancocas Creek NB (below New Lisbon dam)	2.6	-2.8	5.4	-1.6	4.1	5.4
02040202050	Rancocas Creek SB (above Bobby's Run)	3.6	2.8	0.8	13.6	**-10.0**	0.8
02040202060	Rancocas Creek SB SW Branch	3.5	2.2	1.3	2.5	1.0	1.3
02040202070	Rancocas Creek SB (below Bobby's Run)	0.7	1.0	**-0.3**	1.3	**-0.6**	**-0.3**
02040202080	Rancocas Creek	1.0	-7.8	8.9	-7.5	8.6	8.9

Notes:

9) The significance of "losses" is explained in more detail under Section 6 below.

10) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The large volume of water shown to be available for depletive/consumptive purposes in the Rancocas Creek HUC11 watershed is due to the treated wastewater discharges into the Rancocas Creek from the Willingboro STP, Mt. Laurel Township MUA Hartford Road STP, Delran STP and the Riverside Wastewater Treatment Facility.

5) Water Supply Status (Resource Availability)

Table A.19.5 identifies the total resource availability associated with WMA 19. In addition, the table shows 1998-2007 use, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 19 under these three scenarios.

Table A.19.5 WMA 19 (Rancocas) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	18	0	18	4.7
confined groundwater	27	23	5	--
sum:	45	23	23	4.7

WMA 19 2020 Demand and Availability	
current remaining availability	23 mgd
potable use increase by 2020	4.5 mgd
2020 remaining available water	18 mgd

WMA 19 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	2.6 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

When analyzing WMA 19 utilizing the LFM Method, the South Branch Rancocas Creek (below Bobby's Run) is stressed due to consumptive water losses associated with agricultural irrigation and leakage from the shallow groundwater system due to pumpage from the confined aquifers. In addition, the identified stress in this HUC11 watershed can be attributed to the very small September Median Flow value, thus limiting the threshold for available water.

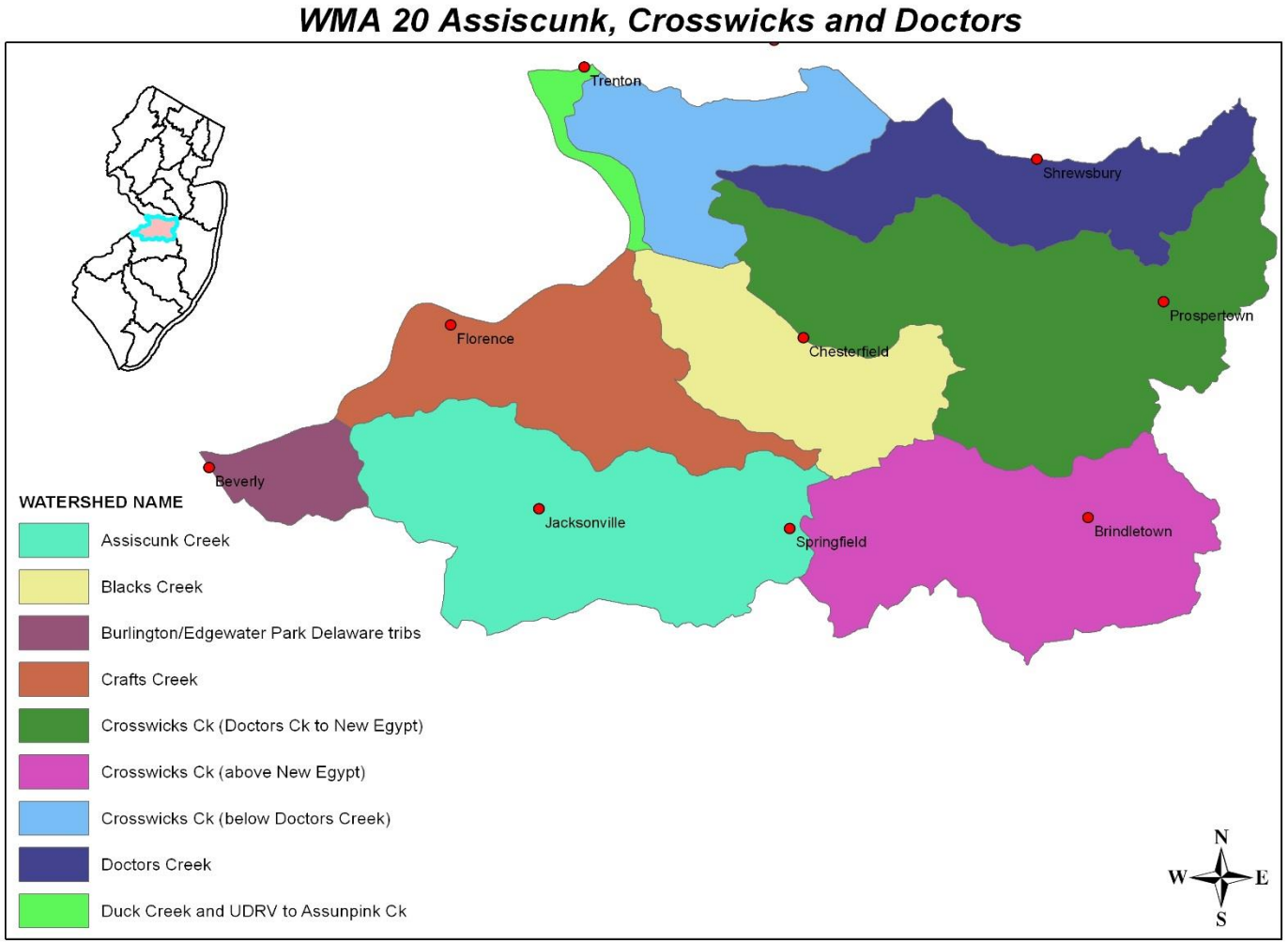
The South Branch Rancocas Creek (above Bobby's Run and below Bobby's Run) HUC11 watersheds are projected to exhibit stress under the full allocation scenario attributable primarily to the same consumptive water losses associated with agricultural irrigation. In addition, the Rancocas Creek NB (above New Lisbon dam) HUC11watershed exhibits minor stress, but this increases under the full allocation scenario. This is attributable to generated wastewater being imported from the adjacent upstream HUC11s, and discharged via the Pemberton Township MUA STP into the Rancocas Creek NB (below New Lisbon) HUC11 watershed.

7) Management Options

- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 19, particularly the South Branch Rancocas Creek (above Bobby's Run and below Bobby's Run) HUC11 watersheds.
- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Rancocas Creek North Branch (above New Lisbon Dam) and the South Branch Rancocas Creek (below Bobby's Run) HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
  - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
  - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the South Branch Rancocas Creek (above Bobby's Run) HUC11 watersheds as it approaches the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.

- For proposed new or expanded water allocations (non-residential water users ≥100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 19.

Water Management Area 20 Assiscunk, Crosswicks and Doctors



Recommended Initiatives for Watershed Management Area 20: Assiscunk, Crosswicks and Doctors

1) Description of Planning Area

Watershed Management Area (WMA) 20 is located in the Coastal Plain Province of New Jersey, borders the Delaware River, and encompasses approximately 249 square miles. WMA 20 includes 26 municipalities, which are located in portions of Burlington, Mercer, Monmouth and Ocean Counties. Major streams within WMA 20 include the Assiscunk, Blacks, Crafts, Crosswicks, Doctors, Duck and Mill Creeks. The largest HUC11 watershed in WMA 20 is Crosswicks Creek. Allentown Lake, Oxford Lake, Prospertown Lake and Imlaystown Lake are the largest surface water impoundments in the Crosswicks Creek Watershed.

2) Background

Summary of Freshwater Withdrawals

Freshwater withdrawals in WMA 20 are derived from confined groundwater, unconfined groundwater and surface water sources. Within WMA 20, the peak annual withdrawal (confined and unconfined groundwater, and surface water) during 1998-2007 amounted to 7,152.73 MGD, of which 0.2% was diverted from unconfined groundwater, 99.5% from surface water and 0.3% from confined groundwater. The daily water use volume breakdown is as follows:

Unconfined groundwater = 11.99 MGD
Surface Water = 7.71 MGD
Regulated Surface Water = 7,111 MGD[13]
Confined groundwater = 22.03 MGD

[13] Please note that regulated surface water (RSW) withdrawals include surface water withdrawals from rivers that are augmented by reservoir releases, diversions from on-stream reservoirs, and pumped storage intakes for potable supply reservoir systems. Only sources with safe yields greater than 10 mgd are included. Withdrawals from on-stream reservoirs are assumed to have captured earlier peak flows and stored it for later use. Withdrawals from pumped storage intakes are intimately related to the safe yield of its reservoir system and assumed to be sustainable. This category also includes unconfined ground-water withdrawals that are in close proximity to and get most if not all of their water from regulated surface water.

Figure A.20.1

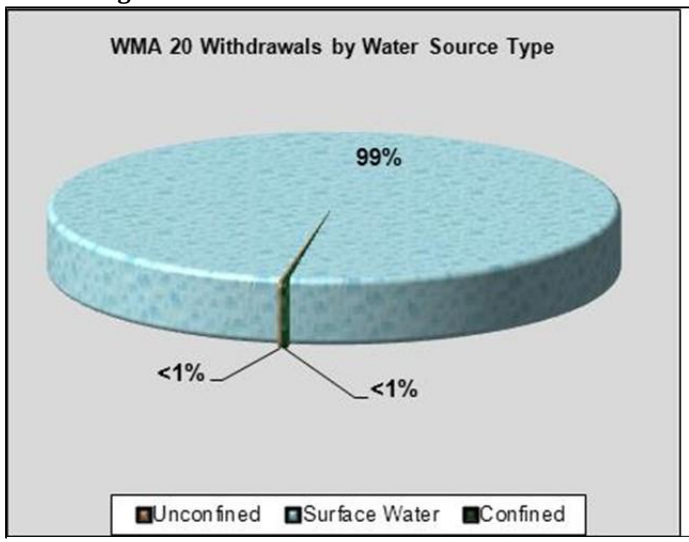
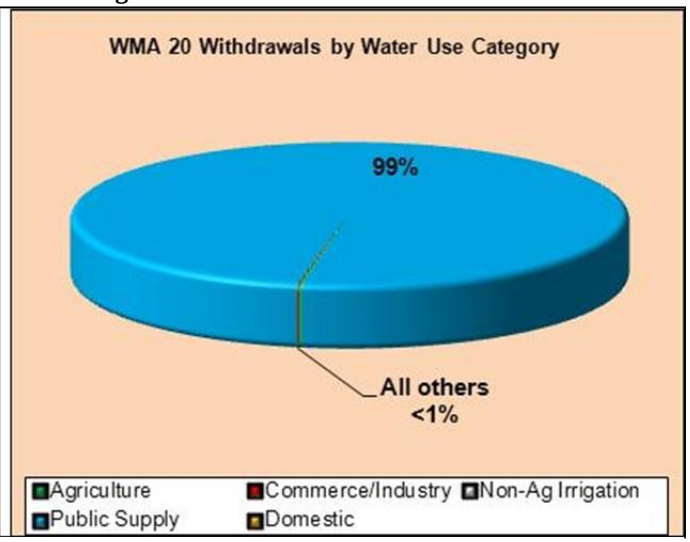


Figure A.20.2



There are five water user types within WMA 20 (public supply, commerce/industry/mining, agricultural, non-agricultural irrigation and domestic supply). Withdrawals by water use category in WMA 20 are as follows: public supply – 7,133.46 MGD (99.7% surface water, 0.2% confined groundwater and 0.1% unconfined groundwater); domestic supply – 2.94 MGD (100% unconfined groundwater); commerce/industry/mining – 4.07 MGD (99% confined groundwater and 1% unconfined groundwater); agriculture – 10.82 MGD (70% surface water, 25%, unconfined groundwater and 5% confined groundwater); and non-agricultural irrigation – 0.99 MGD (85% confined groundwater and 15% surface water). Refer to Figures A.20.1 and A.20.2.

An extremely small portion of this WMA lies within the area designated by the Department as Critical Water Supply Area (Area of Critical Water Supply Concern) No.2 in 1993 (see Chapter 4 for more discussion on this topic). The Critical Area designation was based on excessive withdrawals from confined aquifers in this region and the resulting threat of saltwater intrusion from the Delaware River. As a result, the Department established a policy aimed at stabilizing aquifer water levels through reductions in pumpage from the Potomac-Raritan-Magothy (PRM) aquifer system, the most prolific source of water in the region, and by prohibiting future annual increases in use from the PRM.

Identification of Public Community Water System's Sources

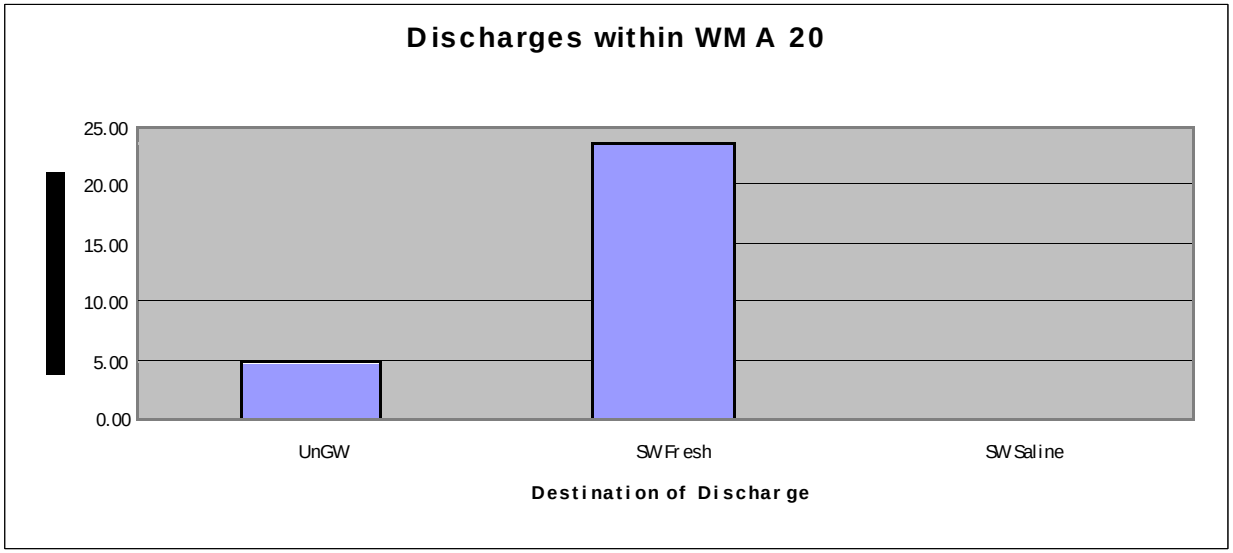
Table A.20.1 lists the purveyors who serve a population equal of 1,000 or more people and have a ground or surface water diversion(s) from an identified HUC11 watershed within WMA 20. Diversion types are noted as follows: Unconfined groundwater (U); Confined groundwater (C); and Surface water (S). Sanitary sewer discharge volumes and sources are shown in Figure A.20.3.

Table A.20.1

Purveyor	Crosswicks Creek (above New Egypt)	Crosswicks Creek (Doctors Creek to New Egypt)	Doctors Creek	Crosswicks Creek (below Doctors Creek)	Crafts Creek	Assiscunk Creek	Burlington/Edgewater Park Delaware tribs
Albert C Wagner Youth Co		C					
Allentown Water Department			C				
Bordentown Water Department				C/U			
Burlington City Water Department					S		
Burlington Twp. Water Department						C	U
Florence Twp. Water Department					C/U		
Jackson Twp. MUA		C					
McGuire AFB	C						
New Egypt Water Company	C	C					
NJ American Water Company – Homestead						C	
NJ American Water Company – Mount Holly						C	
NJ American Water Company – Western Division							U
U S Army Fort Dix	C						
Willingboro MUA							U

For deficit/surplus information pertaining to these individual systems, please visit http://www.nj.gov/dep/watersupply/pws.htm.

Figure A.20.3. 1998 to 2007 Average NJPDES Discharges by Source



3) Population and Demand Projections

Table A.20.2 lists the historical census data and projected populations derived from the Metropolitan Planning Organization (MPO) for each of the HUC11 watersheds located in WMA 20:

Table A.20.2

Hydrologic Unit Code/Name		Historic Population by HUC11			Projected Population by HUC11		
		2000	2005	2010	2015	2020	2025
02040201030	Duck Creek and UDRV to Assunpink Ck	20,349	20,443	20,766	20,936	21,103	21,273
02040201040	Crosswicks Ck (above New Egypt)	12,868	13,100	14,220	14,948	15,522	16,261
02040201050	Crosswicks Ck (Doctors Ck to New Egypt)	17,456	18,717	20,187	21,370	22,723	24,370
02040201060	Doctors Creek	15,581	16,341	17,092	17,577	18,078	18,508
02040201070	Crosswicks Ck (below Doctors Creek)	40,971	42,746	44,132	44,879	45,608	46,271
02040201080	Blacks Creek	10,334	11,411	12,482	12,957	13,345	14,146
02040201090	Crafts Creek	19,533	23,155	25,512	26,399	27,153	29,664
02040201100	Assiscunk Creek	23,996	26,721	28,345	29,578	30,747	32,537
02040201110	Burlington/Edgewater Park Delaware tribs	15,265	15,928	16,214	16,691	17,119	17,537
WMA 20 Total Population		**176,353**	**188,562**	**198,950**	**205,335**	**211,398**	**220,567**

Utilizing MPO population projections and an estimated demand of 100 gpcd, *Table 7.20.3* shows the additional demand estimated for each of the HUC11 watersheds s in 2015, 2020 and 2025.

Table 7.20.3

HUC11	2010 Population	2015 Population	2015 Additional Demand (MGD)	2020 Population	2020 Additional Demand (MGD)	2025 Population	2025 Additional Demand (MGD)
02040201030	20,766	20,936	0.02	21,103	0.02	21,273	0.02
02040201040	14,220	14,948	0.07	15,522	0.06	16,261	0.07
02040201050	20,187	21,370	0.12	22,723	0.14	24,370	0.16
02040201060	17,092	17,577	0.05	18,078	0.05	18,508	0.04
02040201070	44,132	44,879	0.07	45,608	0.07	46,271	0.07
02040201080	12,482	12,957	0.05	13,345	0.04	14,146	0.08
02040201090	25,512	26,399	0.09	27,153	0.08	29,664	0.25
02040201100	28,345	29,578	0.12	30,747	0.12	32,537	0.18
02040201110	16,214	16,691	0.05	17,119	0.04	17,537	0.04
Totals	**198,950**	**205,335**	**0.64**	**211,398**	**0.62**	**220,567**	**0.91**

4) Available Water for Depletive/Consumptive Uses – Unconfined Groundwater/Unregulated Surface Water

Table A.20.4 identifies the remaining water available for depletive/consumptive uses (MGD) for unconfined groundwater/unregulated surface water **supplies** in each of the nine watersheds in WMA 20 under three different scenarios -- 1998-2007 use, full allocation, and projected population/water demands for 2020. The values for 1998-2007 use, and full allocation remaining available water for depletive/consumptive uses were calculated by subtracting the estimated depletive/consumptive losses at 1998-2007 use and the projected depletive/consumptive (D/C) losses at full allocation from the identified available water as per the LFM methodology. For additional information pertaining to each HUC11 watershed, please refer to Appendix 4.5 – Summary of Low Flow Margin Results.

The values for the 2020 demand scenario were obtained by subtracting the depletive/consumptive losses that are projected to occur in 2020 based on increased population growth from 1998-2007 levels remaining available water for depletive/consumptive uses. All future demands are based on a calculation of projected population increases multiplied by an average daily demand of 100 gallons per person per day. All future demands were also assumed to be entirely depletive/consumptive.

Table A.20.4

HUC11	HUC11 Name	Available Water for D/C Loss (MGD)	(1998-2007) D/C Water Loss (MGD)	Remaining Available Water for D/C Uses (MGD)	Full Allocation D/C Water Loss (MGD)	Full Allocation Remaining Available Water for D/C Uses (MGD)	Water Available for D/C Uses in 2020 (MGD)
02040201030	Duck Creek and UDRV to Assunpink Creek	0.1	-9.7	9.7	-9.7	9.7	9.7
02040201040	Crosswicks Creek (above New Egypt)	2.4	1.6	0.8	2.3	0.1	0.8
02040201050	Crosswicks Creek (Doctors Creek to New Egypt)	3.0	3.7	**-0.7**	10.5	**-7.5**	**-0.7**
02040201060	Doctors Creek	1.3	2.2	**-0.9**	6.2	**-4.9**	**-0.9**
02040201070	Crosswicks Creek (below Doctors Creek)	0.6	-5.4	6.0	-5.2	5.8	5.9
02040201080	Blacks Creek	0.9	0.3	0.6	5.9	**-4.9**	0.6
02040201090	Crafts Creek	0.5	0.5	0.0	1.1	**-0.6**	**-0.1**
02040201100	Assiscunk Creek	0.9	2.0	**-1.1**	3.5	**-2.6**	**-1.1**
02040201110	Burlington/Edgewater Park Delaware tribs	0.2	-1.6	1.7	-3.3	3.5	1.6

Notes:

11) The significance of "losses" is explained in more detail under Section 6 below.

12) *A negative value in a loss column (shaded blue) indicates a gain to the HUC11 watershed.*

The volume of water shown to be available for depletive/consumptive purposes in the Crosswicks Creek (below Doctors Creek) HUC11 watershed is due to the treated wastewater discharges into the Crosswicks Creek (below Doctors Creek) from the Hamilton Township Water Pollution Control Facility.

5) Water Supply Status (Resource Availability)

Table A.20.5 identifies the total resource availability associated with WMA 20. In addition, the table shows 1998-2007 demands, full allocation and estimated 2020 demands and the corresponding remaining available water supply in WMA 20 based on these three demand scenarios.

Table A.20.5 WMA 20 (Assicunk, Crosswicks and Doctors) Available Water and Demand, by source

Source of Water	Demand & Availability (mgd)			
	total availability	current demand	current remaining availability	full allocation remaining availability
surface-water reservoirs	--	--	--	--
run-of-the-river intakes and unconfined groundwater	10	-6	16	-1.3
confined groundwater	22	19	4	0
sum:	32	13	20	-1.3

WMA 20 2020 Demand and Availability	
current remaining availability	20 mgd
potable use increase by 2020	3.5 mgd
2020 remaining available water	16 mgd

WMA 20 Options for Additional Water Supply	
ocean/bay sanitary sewer discharges	--
potable conservation savings	0.4 mgd
unbuilt water supply projects	--

6) Primary Causes of Stress for Unconfined Groundwater/Unregulated Surface Water Sources

In WMA 20, when analyzing the LFM Method, the Crosswicks Creek (Doctors Creek to New Egypt), Doctors Creek and the Assiscunk Creek HUC11 watersheds are shown to be stressed and are projected to exhibit stress under the full allocation scenario, due to the consumptive water losses associated with agricultural irrigation. The Blacks Creek HUC11 watershed is also projected to exhibit stress under the full allocation scenario primarily due to the same consumptive water losses associated with agricultural irrigation. The identified stress in the Crafts Creek HUC11 watershed under the full allocation scenario can be attributed to the very small 7Q10 and September Median Flow values, thus limiting the threshold for available water.

7) Management Options

- DEP will promote the efficient use of the State's limited freshwater resources as outlined in the Plan (see Chapter 7, Policy Item #1).
- Evaluate 5-year development plans in order to comply with the Agricultural, Aquacultural and Horticultural Water Usage Certification Rules (N.J.A.C. 7:20A-2.4(d)3) for all agricultural facilities located in WMA 20, particularly the Crosswicks Creek (Doctors Creek to New Egypt, Doctors Creek, Assiscunk Creek and Blacks Creek HUC11s.
- All new depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water in the Crosswicks Creek (Doctors Creek to New Egypt), Doctors Creek and Assiscunk Creek HUC11 watersheds should be evaluated prior to Department approvals associated with future water supply and wastewater decisions.
    - If deficit continues, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- DEP will continue to monitor the Blacks Creek and Crafts Creek HUC11s as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water.
    - If deficit occurs, additional depletive/consumptive uses should be offset through mitigation.
    - Mitigation includes: permanent removal/reduction of and existing depletive/consumptive use, increased storage; or increased recharge.
- For proposed new or expanded water allocations (non-residential water users ≥100,000 GPD), where more than 50% of the water will be used for consumptive, non-potable purposes, discourage the use of potable water sources.
- Investigate utilizing the NJ American Water Tri-County project as a source of water for new or expanded uses (not including agriculture) in WMA 20.